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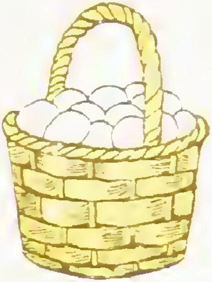
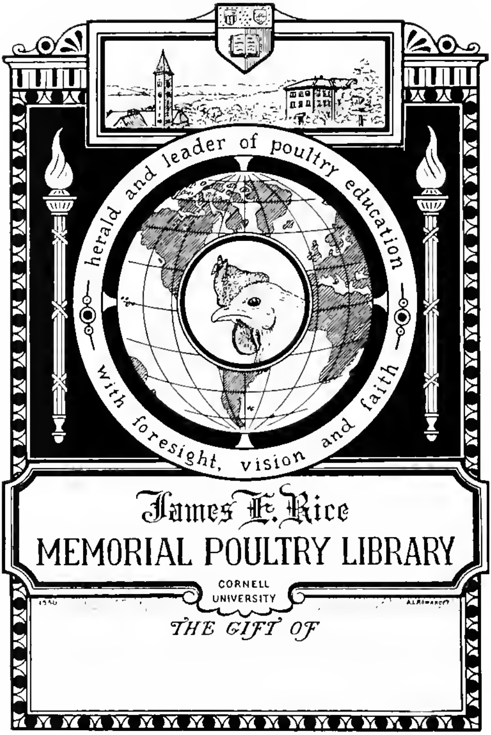
"Experientia docet sapientiam."



Utility Poultry Farming.

BY J. STEWART REMINGTON
AND M. E. REMINGTON.



herald and leader of poultry education — with foresight, vision and faith

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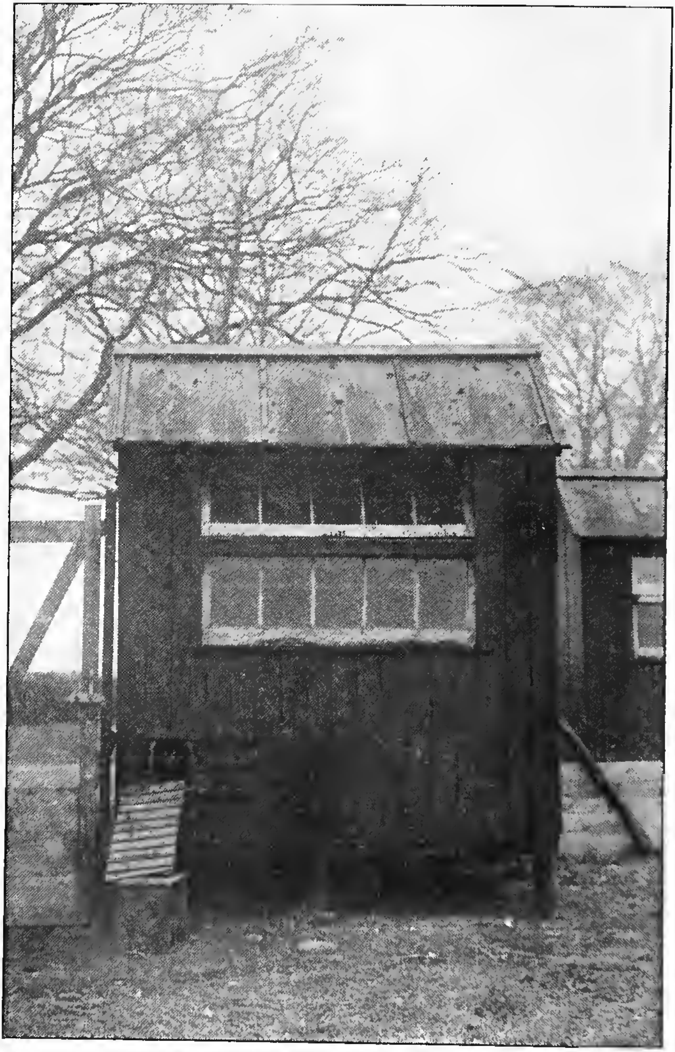

ORDINARY PEN HOUSE.

"*Experientia docit sapientiam.*"

Notes on Utility Poultry Farming

BY

J. STEWART REMINGTON

AND

M. E. REMINGTON.

ILLUSTRATED.

GRANGE-OVER-SANDS:
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PREFACE.

THESE notes, of necessity somewhat fragmentary, have been written to encourage people in the National importance of Utility Poultry Keeping, and to indicate the way how poultry may be kept as a business, and at the same time made an interesting hobby.

My wife started her farm first of all to help her country, by producing food for the community; secondly, to show the farmers and our neighbours what could be done with poultry if worked on scientific and business lines; and thirdly, not being able to leave home to undertake war work at a distance, she thought as we lived in the country, and having been devoted to poultry all her life, it was the right thing to do. Further, she has the advantage in having an experienced poultry-man.

The farm is one of 10 acres, and I have no hesitation in saying that the results, so far, have amply justified the expenditure of capital made, and that Commercial Poultry Farming, when carefully conducted as a business, is not only of daily increasing interest, but a sound commercial investment, the return more than compensating for the time and labour expended upon it.

The Poultry Farmer will, naturally, as in other business undertakings, have difficulties to face from time to time. Let his or her motto be "Nil desperandum," and further, remember, that by supplying a much-needed and useful article of food, this is certainly helping to counteract the foreign importation of eggs, and keeping money in circulation at home.

THE LONGFIELD POULTRY FARM,
NR. GRANGE-OVER-SANDS,
LANCASHIRE.
February, 1919.

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Notes on Utility Poultry Farming.

CHAPTER I.

Starting a Poultry Farm.

The war which has lately convulsed Europe has brought before us many problems of urgent importance, which before August, 1914, had received little, if any, serious attention. Amongst these, the possibilities of the land, and how to employ our people so as to make us a nation independent of foreign markets; and imported food stuffs have been brought prominently to the front.

Amongst the pressing problems which will have to be faced in the near future is the question of finding suitable employment for numbers of discharged soldiers, and no calling offers such attractions as some form of occupation connected with the land. When we compare the agricultural facilities of the United Kingdom with other countries, it will be found that we are able, provided we organise our agricultural resources properly, to support some thirteen millions of persons on the land, and whereas before the war we were employing about two and a half millions, it is now practically certain we could profitably employ nine to ten millions more people, and thus insure an enormous increase in our home-grown produce.

Among the many neglected occupations, that of Commercial Egg Farming and Utility Poultry Culture offer special attractions.

Prior to the war the United Kingdom imported nine million pounds sterling in eggs, but with proper organization, worked on scientific and commercial business lines, there is no reason why this very large sum of money should not be kept at home, and not be handed over to foreign producers.

The fact that many English railways carried over their lines prior to the war large quantities of foreign eggs at lower rates than the British farmer paid for his own eggs to market, was by many people regarded as a striking example of the preference that has been alleged to have been shown by our Railway Companies to the foreigner in the past. It must be pointed out, however, that in spite of the good work of the National Poultry Organization Society, to increase the interest in egg production, it has only been during the last few years, especially since the importation of foreign eggs has been cut off, that methods have been organized, and the important business of Commercial Egg Production on a large scale has received the attention it deserves.

That the business has immense possibilities when worked on a large scale in a scientific manner, may be gathered from the study of the foreign egg trade in past years, when it is considered that 10,000 to 15,000 cases of eggs, between April and August, were sent weekly to one firm in London by sea, whilst from September to March the same firm received 10,000 cases weekly from Lemberg

(Galicia) via Harwich. Large quantities also came from Hamburg and from Roumania into Great Britain. There were, in fact, special continental egg trains, consisting of 30 or more waggons, each holding 10 tons.

In 1902 this country received from Italy 315,000,000 eggs. Denmark, through effective organization, had an export trade in eggs which rose from £400,000 in 1895 to £1,270,000 in 1902, the total number of eggs imported into the United Kingdom in 1902 from Denmark being 422,000,000. Other countries importing large quantities were France, Russia, Bulgaria, Egypt, China and Morocco.

Since 1902, up to the time of the declaration of war, the import of eggs into the United Kingdom has been increasing, so that with the outbreak of war a very important foreign export industry was cut off. It is to be hoped that through the steadily growing interest for this industry prior to the war, and the still greater interest and enthusiasm manifested since that time, efforts will be made to greatly augment and firmly establish Commercial Egg Farming in the United Kingdom.

Since the war, we have shown that we are capable of producing in these islands much larger quantities of food stuffs sufficient for 40 weeks' supply. Before the war, because we were able to buy all we required, we troubled very little about such matters. There was no thought given to organization, and the need of special instruction, except in a few isolated cases. Little thought was given to the important business of agriculture, as so well understood in many foreign countries, such as France, Germany, and the United States, and that the time would ever come when it would be an absolute necessity to produce more food at home, was never seriously considered. The war, however, has given us a rude awakening. It is now seen that foreign competition must be mastered, and that it is by science and scientific methods alone that this can be accomplished. Science as applied to food stuffs, science as applied to selection of stock and breeding, as applied to marketing and grading of produce, and as applied to business methods generally.

As regards Poultry and Egg Farming, this also must be worked scientifically. It will not pay if carried on by rule of thumb methods so frequently practised and thought sufficient by amateurs. It is with the desire to see this important industry developed to its greatest capacity, that it has been thought desirable to give some general notes as regards the starting of a Poultry Farm for high-class Utility Stock and Egg Production.

In starting a Commercial Poultry Farm, the best advice to any one is, commence from the beginning, and build up the farm year by year until the ultimate size determined on has been attained. This is much better and sounder business than taking over an existing concern. If a poultry farm is in the market, very careful enquiries are necessary as to the reasons for disposal, and unless these reasons are most carefully looked into, an undertaking which at first sight has appeared all that is to be desired, may be the cause of endless anxiety, labour, expense and loss.

In starting a new farm, too much care cannot be given to the question of a suitable site, proximity to markets, suitable soil, good drainage, grass, water and shelter, and, moreover, plenty of room for expansion.

Now as regards capital to start a poultry farm, it is sometimes suggested that £100 would be sufficient, assuming the farm is to be run as a commercial egg farm, but such statements are only made by irresponsible persons, who certainly do not intend to make poultry farming their chief business. On the other hand, any person having an interest in fowls can easily start in a small way on a capital of about £30, by keeping a few hens of a good recognized breed, and following the practice of carefully trap-nesting, and recording the results. Apart from the interest in so doing, immense benefit will result all round by increasing the number of high-class Utility Poultry in the country, and whether a few hens are kept or a large flock for commercial purposes, the same care and scientific management should be exercised.

Again, as regards capital, whether a small flock is kept or a large one, which in the latter case may have entailed the investment of anything from £800 to £2,500 to start with, it is equally imperative that the money made during the first two or three years should be re-invested in further increasing the stock and plant, and placing the undertaking, whether followed as a hobby or a business, on a sound basis.

Now, to start with, the best pure-bred Utility Stock should be chosen, such as White Wyandotte, Leghorn. Light Sussex, Rhode Island Red, or any other recognized trap-nested breed, according to the fancy of the individual, For the heavy breeds the pullets should be hatched from the beginning of March to the end of that month, whilst the light varieties may be taken up to the middle of May. These pullets should be obtained from recognized trap-nested stock from a breeder of good repute, having records which have shown from their pullet year an average egg yield of not less than 200 eggs for the twelve months, the eggs weighing a good two ounces.

Having obtained suitable pullets, these should be trap-nested, and any that have laid 220 to 280 eggs or over, provided they lay a good egg, are a very valuable asset to the stock for making up special pens.

It is very important to avoid in-breeding, and it is therefore necessary to see that new cockerels are mated to pullets of unrelated blood. When it is found that a cockerel breeds good pullets, it is desirable to keep him and go on using him for several years, if possible, always mating him each season with a few unrelated pullets, and in this way any one who bestows attention and care on their birds should keep up an excellent strain. The eggs obtained from these special hens are kept for hatching, to rear the stock-cockerels for selling at a good price, or for keeping for one's own use if thought desirable.

A good egg hen passes down her good qualities to the cockerels hatched from her eggs, and if a first-rate unrelated cockerel is mated to her, the cockerel will pass his good qualities on to the pullets. It will, therefore, be seen that whether poultry keeping is carried on either in a small way or a large, it is most essential to always have a good cockerel, and to have him straight from a special egg hen, and not from a pen of birds, as from a pen of birds one would only get the strain. This point is most important and cannot be too strongly emphasised. So many people go on the assumption that any pure-bred cockerel will do, and in so doing go entirely wrong. The advice given is just as important to the small poultry keeper as to the large owner who carries on poultry farming as a business.

By buying a good cockerel and using common sense, the greatest success should result as regards the pullets the following year, for it will have been through the cockerel that good pullets are obtained. By the above means the stock can be increased year by year, and the strongest birds and the best results attained.

It is further desirable to keep as many year-old birds to breed from as possible, for though it is a temptation to rear off pullets, much better results are produced by rearing off year-old hens mated to cockerels, and it will be found to pay much better to keep them.

The result of following the above advice, as regards the small man, will be well repaid; apart from the pleasure, there will be the interest, after a few years, of owning good sound stock; further, by carrying out the methods indicated, will most certainly guarantee a full egg basket. In the case of the large Poultry Farmer, I cannot do better than recommend the methods laid down by Mr. S. G. Hanson, in his excellent little book "Commercial Egg Farming" (Constable & Co.) The principles of his system are:—

(1) To breed from constitutionally vigorous hens, of pure breed—Mr. Hanson's choice being White Leghorn

that have completed their second year and shown a productiveness of at least 144 eggs per bird.

(2) To mate these hens to cockerels, one-year-old birds, bred from trap-nested stock, whose mothers have in their pullet year laid not less than 200 eggs per bird; the cockerels used being vigorous and of good type.

(3) The chickens from these matings are brought up entirely on dry food; no wet mash being given at any period of their lives, and any chickens that look weak or are defective are killed.

(4) The pullets are run in flocks of 400 birds, no cockerels being run with them.

(5) Infertile eggs are the only ones sold for eating.

(6) The breeding pens consist of 400 two-year-old hens mated to cockerels run as one flock.

(7) Each house is 180 feet long, holding 400 birds, and stands on one acre. The Southern half is in use in winter; the Northern half in summer. Each yard, as it is vacated, is ploughed and harrowed and sown with thousand-headed kale.

(8) Dry mash alone is used for feeding, accessible to the birds at all times.

In conclusion, let me strongly urge those who wish to succeed with poultry to carefully remember the following:

(1) In selecting layers, look for—(1) A sharp bright eye rather light. (2) Rather narrow head, the eyes projecting from the skull. (3) Fine textured comb, not too large. (4) Stout short beak, and rather short head. (5) Short thin neck. (6) Long back, wide across the wings. (7) As short a breastbone as possible. (8) Rather short

legs with a good width between. (9) Good wide cushion. (10) As long a distance as possible between the breastbone and the pelvic bones. (11) Wedged-shaped appearance, tail carried high. (12) Medium-sized birds.

These points have been stated by Mr. T. Barron, the well known Utility Poultry breeder.

(2) Always employ pure-bred stock ; no poultry farm was ever established on mongrel birds.

(3) Never keep non-essential stock.

(4) Keep the pullets growing until sufficiently developed.

(5) Always get the pullets right out of the chicken stage before starting to feed for eggs.

(6) Get the pullets to lay about the second or third week in October.

(7) A pullet of the sitting breed should be about seven months old before she commences to lay. A non-sitting breed, at least six months.

(8) Always keep exact records of egg production, i.e., trap-nest.

(9) Always have a rational arrangement of food and let your feeding times be regular; a correctly fed hen always lays more eggs than one incorrectly fed.

(10) Always keep fresh water before your birds, and see that the drinking troughs are clean.

(11) Keep the houses scrupulously clean and disinfected, the dropping boards sprinkled with saw-dust, and do not leave the litter too long to get stale, dusty or dirty.

(12) Always see that grit and shell-forming material

is available and granulated charcoal.

(13) Give green food, such as mangolds, sugar beet, cabbages, kale, etc.

(14) Always fork the grain into the scratching litter to promote exercise.

(15) Do not over-crowd your houses.

(16) Give plenty of light and air.

(17) Finally, give personal supervision and labour, use method, and do not expect good results unless you do.

View on the Farm.

CHAPTER II.

Poultry Houses.

THE following notes are to present, in concise form, some of the essential points as regards Poultry House construction, and the setting out of a Poultry Farm.

It is not necessary for all poultry keepers to have the same type of house in order to obtain satisfactory results, but there are several well-established principles which must be considered if good results are to be secured.

A good house should be water-tight, so as to furnish dry, comfortable quarters, and entirely free from draughts. It should be well ventilated and have abundance of light.

Houses should be constructed to meet two extremes of temperature, which are very clearly indicated by the increase in the price of eggs. The highest price of eggs comes during the late autumn and early winter, and unless a house is well made and warmly constructed the egg yield will fall unduly, by which is inferred that the egg return will drop below the minimum which may be expected at such a season, and hence some of the year's profit may be lost. On the other hand, during July and August, one may experience very hot and close nights, and it is, therefore, desirable that the house should be cool and well ventilated, or a decrease in egg yield may result.

It is most essential to keep the poultry house clean; the droppings should be removed every day, and the house disinfected at regular intervals. As previously stated, there should be plenty of light, a safe proportion of glass to use being 1 sq. foot of glass to each 12 sq. feet of floor space. However clean a house is kept, there will be harmful germs present, hence plenty of light assists in destroying them, as sunlight is the best germ killer.

Fowls give off a great deal of moisture from their lungs; it is, therefore, imperative that good ventilation should be provided to take the bad air and moisture away, as impure air and dampness are closely associated, and are nearly always due to improper ventilation.

The timber used for a poultry house should be sound and well seasoned, so that when the house is built there will be no fear of shrinkage. The best wood to use is match-boarding which has been tongued and grooved. The most desirable boarding for construction purposes is one inch thick, if you can get it; but if the house is properly and carefully erected, five-eighth inch boards will do. If built with the lighter boards, the roof and sides should be covered with tar-felting.

The floors are sometimes made of concrete, which has been laid on broken bricks and stones so as to raise the house about 8 inches above the ground. The best floor and cheapest in the end, however, is made of wood, and can be kept in a much more sanitary condition than if composed of concrete or of earth. Moreover, houses so constructed are much warmer, as a concrete floor is cold and hard, and nine out of ten earth floors are damp.

Poultry houses should be raised about 12 to 14 inches from the ground, either on bricks or wooden legs. In the latter case the legs should be well creosoted. The under-side of the boards forming the floor should be lightly tarred prior to being laid, as the smell of the tar repels both rats and mice. By having the house raised this will insure a good current of air underneath and will keep the floor dry.

A house situated in a wired-in run should have the back and sides boarded from the ground to the floor level, but the front can be left open, and will afford shade in the hot weather for the birds. The ground underneath such a house will be nearly always dry, even in wet weather, having previously had ashes placed underneath, and thus forms a very efficient dust bath in which the birds may roll and rid themselves of vermin.

In planning or laying out a poultry farm, the houses for the breeding stock should be built in one or more ranges with a gangway between. The houses should have a southern aspect, if possible, and should have two runs to each house, so that the birds may be changed about, and the grass in one run given a rest whilst the other is in use.

The partitions between the runs should be so constructed that there is no danger of the birds fighting each other between the wires. The more space that can be allowed for the runs, the better ; but about 100 square feet of grass per bird is usually stated as the requisite amount to keep grass-penned birds in a healthy condition.

To keep the grass runs sweet, they should be limed, and sprayed with "Izal" solution in the autumn. It is also an excellent plan to run some sheep on them. Should the grass look poor, a dressing of bone meal or basic slag will be found very beneficial at the rate of between 5—6 cwt. per acre. The requisite quantity for so many yards of space can be easily found by consulting the table at the end of the book.

At the Longfield Poultry Farm there are two grass runs to each pen, 20 yards by 10 yards. The houses are 7 feet wide, height at the centre 8 feet, front 6 feet, and the back 5 feet. The pen houses have back windows which do not open, and are placed a little above floor level to admit light. These windows are 3 feet long by 14 inches high. The front windows of these houses are divided into two sections, and can be inclined backwards either both together or separately, and admit abundance of air without allowing cold draughts to reach the birds. These windows have a rocking wire screen inside to prevent the birds lodging on the windows, when inclined.

The front of some of the windows of the pen houses have flap shutters or wooden screens, 4 feet by 20 inches long by 2 feet, which can be opened at any angle by angle iron-supports, thus giving shade to the interior of the houses in hot weather, and can be entirely closed in cold weather or at night.

The pen houses are raised 14 inches high above the ground. The dropping boards are 2 feet 6 inches from the board floor, and the perch poles two in number, 7 inches above the dropping board. The trap nests are under the front windows.

The number of birds kept in these pen houses are twelve for the light, and eight to ten for the heavy breeds. The illustration will give a good general idea of the exterior construction of one of these houses.

The pens are wired in, being boarded 2 feet up, and the rest, wire netting, 7 feet in height.

The Brooder House is 9 feet high at the roof ridge, 5 feet high at the eaves, the length being 64 feet. There are six windows each side, which can either be inclined to admit air or can be completely taken out, 2 feet by 1 foot 4 inches. Near the floor a similar number of windows are placed to admit light only, 2 feet 8 inches by 1 foot. The compartments of this house are 8 feet by 4 feet 6 inches, and each compartment has a grass run 20 yards by four yards, wired round 5 feet high and boarded up 2 feet, the wire being 2 inch mesh. A gangway runs down the middle of the house 3 feet 6 inches wide. The compartments are all provided with hovers, heated by oil lamps, and are boarded up 2 feet, and then wired to the roof.

There are nine big houses, of which four are 16 feet long by 14 feet wide three-quarter span, divided into two compartments 8 feet by 14 feet, the front being 7 feet in height, and the back 6 feet. Each compartment has double flap windows of similar construction to the pen houses. The laying boxes are arranged beneath the windows. The grass pens of these houses are 48 yards by 40 yards, the houses each accommodating one hundred birds.

The other houses are 40 feet long by 9 feet wide, 7 feet 6 inches high at the front, and 4 feet 6 inches at the back, being boarded up 3 feet, leaving a series of windows the whole length, 4 feet high, which open up and down.

These houses accommodate one hundred birds each. The pens of the farm are planted with apple trees. The smaller pens each having three trees, and the big ones fifty trees each.

The photographs given will clearly show the general exterior of the big houses. In addition, it is necessary on a well-appointed Poultry Farm to have a good store house, about 24 feet long by 16 feet wide, with adequate bin room for the different foods used. The store room should be built with a rat-proof floor, the store house being 2 feet from the ground, and reached by steps having a suitable outside staging at the door, for the easy delivery of a sack of grain or other food when carried on a man's back.

The Incubator House is a stone-built building, with slate roof, boarded inside, having no windows but sky lights only, which are covered by dark greenish blue calico blinds on spring rollers. These are only raised when the eggs are being turned in the morning. In addition, there is a wooden house used as an egg store and packing department. A small pen house is also kept to put newly-arrived birds in, where they can be housed and kept under observation, for a day or so, to ascertain whether they are healthy before turning them in with the other stock. Such a house can also be used as a hospital for birds requiring treatment, if necessary.

The description given will illustrate the general arrangement of an up-to-date Commercial Utility Farm for 1,000 to 1,500 head, but the exact details can only be determined by each individual poultry keeper after he or she has decided on the size of the farm, and the class of trade it is intended to cater for.

It concluding this chapter, do not let the above remarks deter the small man who only may wish to expend £30 to £50 on poultry. If such a one does keep poultry, let him keep some good utility stock; on the other hand, it must be remembered that the future problem before this country, as far as poultry is concerned, is to have large farms of from 1,000 to 5,000 head, otherwise the combating of the foreign egg supply will be in vain. It is for this reason that not less than £800 to £2,500 capital has been recommended. It must be remembered we have not only to think of ourselves; we have to think of the welfare of our country—its commerce, and the future, and in all we do, try and raise this important industry to such a position, that whether a poultry keeper works in a small way or a large, the result of the time, thought, and labour expended shall insure for the future British eggs for British workers.

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CHAPTER III.

Notes on Incubators.

In considering the question of artificial incubation, the choice of a suitable house is most important. However perfectly the incubating machines may be, no good result can be obtained if they are placed in an unsuitable building. Wooden structures are sometimes used, but most of them are unsuitable. Corrugated iron roofs are very bad, because of the difficulty of maintaining an even temperature.

The best type of building is made of brick or stone with a concrete floor, the roof being slate boarded underneath, with no windows, but having two or more sky-lights, with dark green or blue calico blinds working on spring rollers. These blinds are essential, because direct sunlight falling on the incubator is very likely to raise the temperature to a point beyond the power of the regulating device. Further, the Incubator House is best kept comparatively dark. It is very essential to ensure the room being dry, as a damp place is very undesirable. At the same time it is very necessary that the atmosphere be kept fresh, as in a room with say twenty or more machines, the air is likely to become foul, due to the fumes from so many lamps being in use at one time.

The situation of the Incubator House should be sheltered, as the maintenance of an even temperature in the house is necessary; therefore the location should be such that the rays of the sun do not play on the roof of the building on the one hand, nor the full force of cold winds, so frequent in early spring, on the other. Further, the house should be built in a quiet situation as far removed as possible from noise and vibration.

What has just been described, is an ideal incubator house for a large Poultry Farm. For those who have one or two incubators only, a cellar, if perfectly dry, may be used with advantage. An upstair room or a loft has the disadvantage by reason of the vibrations due to the opening and shutting of doors beneath, and the shaking caused by walking heavily on the boarded floor.

There are quite a number of good incubators on the market—the ones used at the Longfield Poultry Farm being the "Gloucester." These are used because they have been found so easy to manage, and excellent results have always been obtained, but there are many others of just as good and reliable construction and design.

The choice of a machine is best left to the individual. Not all eggs from the best breeding stock will be found suitable for hatching purposes. They may be poor in shape, inferior as regards texture of shell, or small in size. Small eggs should not be used for incubation, as they rarely hatch well, and pullets from them frequently produce small-sized eggs. Moreover, small eggs are not wanted, and, as previously stated, what the market wants is an egg weighing a good two ounces. Only clean eggs should be selected for incubation; a dirty egg, which has been washed, never will hatch well.

Eggs begin to incubate at 68 deg. F. Care should be taken to keep them below that temperature, say anything from 45 deg. F.—55 deg. F., though they will be quite satisfactory if kept as high as 65 deg. F.

Eggs should be set as soon as possible, and should not be stored longer than is absolutely necessary, but they can be kept for a fairly long period, if they are turned several times during that time.

Incubators are divided into two general types, viz.—"hot air" and "hot water," and are heated by gas, oil lamps or electricity. Some very large incubators of American construction are heated by coke or anthracite stoves—such machines taking thousands of eggs at one time—the latest types being arranged to turn all the eggs mechanically at once, the device being operated by a hand wheel at the side of the machine.

An incubator should always be level, because if one side is higher than the other the heat will be greater at that part of the egg chamber, leaving the rest of it comparatively cold.

Before starting to use an incubator, it should be well-disinfected with a solution of "Izal," about 5 per cent. strength. The lamp must be carefully filled and the wick well trimmed. The oil container of the "Gloucester" incubator will last three weeks. Any oil left over from the previous incubation should be removed from the container, and new oil put in when a fresh start is made. Old oil and dirty wicks are often the cause of endless trouble as regards the lamps, and cause smoking. The wick should have the corners so trimmed that when lighted it will give a round flame. The incubator thermometer should be tested at intervals. Because the thermometer is correct for one hatch, that is no reason why it should be correct for the next or accurate another season. The best way of testing the thermometer is to compare it with a standard clinical thermometer. Both should be placed in a basin of water at a temperature of 105 deg. F., and should be moved backwards and forwards for about a minute, the bulbs being completely covered all the time. If the temperatures register the same, it may be safely assumed that the incubator thermometer is correct. If found incorrect, another instrument should be secured.

Before placing the eggs, the incubator should be run about a week to see that it is working correctly If it does not do so, the thermostat, or ether-wafer which operates with the thermostat, should be looked to, and no eggs should be set before they are in perfect adjustment.

Whatever type of incubator is used, it is usual for the maker to supply a book of instructions. These should be carefully read over before a start is made. Different incubators work differently, and it is, therefore, impossible to give directions which would cover every condition.

The temperature varies with the type of incubator, position of the thermometer, time of year, and the length of time the eggs are cooled.

The eggs from the smaller breeds have a tendency to hatch out a little earlier than those from the larger varieties of fowls, but the most successful hatches take place about the twentieth or twenty-first days.

After the eggs have been introduced, which is best done in the morning, because cold eggs will cause a fall in temperature, it will be necessary to watch the machine, to see that at the end of twelve hours it is going steadily again. After twenty-four hours the eggs will require turning, and after this, the operation of turning should be carried out twice a day.

The eggs are usually marked with a X on one side and an O on the other, so that all the crosses are on the top at one turning, and the O's at the next, and so on.

The eggs are not lifted from the tray of the machine at each turning, but can be gently rolled half-way round with the tips of the fingers. During the time the eggs are being turned they will be getting their necessary cooling or airing. When the weather is cold this airing should not exceed more than five minutes for the first week, eight to ten minutes for the second, and about fifteen minutes for the third, but in warm weather, about seven, twelve, and twenty minutes respectively may be given.

About the seventh or eighth day it is usual to test the eggs, and remove the addled and infertile ones. This is usually done with the aid of a special egg testing lamp or by a simple egg tester and candle. The egg tester is made of metal or wood, painted black with an egg-shaped hole in the middle. When this is held in the left hand in front of the candle, the egg is held by the right hand before the hole, so as to see through it. If the egg appears clear and transparent it is infertile, if it should appear as a dark solid mass with an indistinct red streak at the side, this condition would indicate that the germ has died, in other words, it is addled ; on the other hand, if a network of blood veins are seen, it can be safely assumed that the process of incubation is proceeding in a normal and satisfactory manner.

It may be well to further state that if the bulb of the thermometer is placed on a fertile egg, it should register 102 deg. F. during the first week, and rise about one degree during the period of incubation. A thermometer hanging an inch or so above the eggs, as in the "Gloucester" incubator, should register a temperature of 103 deg. F. and keep this temperature during the entire period.

Ventilation in the incubator is important. Evaporation takes place from the eggs, and in some types of machines pans of water are necessary to supply the moisture which is evaporated away.

In cases where the chick only manages to "chip" the shell, but is unable to complete the task, it will be found that this is most likely due to the toughness of the membrane through the atmosphere being too dry, or to weakness of the chick brought about by (1) the eggs being rather old at the start ; (2) overheating through the regulator not working correctly ; (3) the eggs getting chilled during the period of incubation or using eggs from inferior stock.

The chicks on hatching out are placed in the drying-off box or compartment. In machines like the "Gloucester" they automatically find their way there, whilst in others they require lifting out and placing in the drying box which is situated at the top of the incubator.

After hatching, the chicks require no food for the first twenty-four to forty-eight hours.

In concluding these notes, the following points should be carefully remembered :—

(1) If you want healthy chicks, keep your breeding stock in the best of condition.

(2) Do not buy a cheap incubator; it is generally the dearest in the end.

(3) Do not make a noise in the incubator room; perfect quiet is essential.

(4) Do not neglect to turn the eggs up to the nineteenth day, but on the first signs of "chipping" no further turning is necessary.

(5) Do not open the incubator drawer too often during hatching, but as soon as a fair number of chicks have hatched out, remove them to the drying-off chamber.

(7) Chicks which are too weak to gain their own liberty are not worth keeping; you had better kill them.

(8) Do not bother with chickens which show undue weakness. It is much better to kill them. By keeping them you are only increasing stock of weak constitution.

CHAPTER IV.

The Rearing of Chickens.

Having obtained a successful hatch from the incubator, on the lines described in the previous chapter, the chicks are taken from the drying box of the incubator to the Brooder House. It is necesssry to be very careful not to expose them to any chill; so if the Incubator House is some little distance away, it is best to carry them in a box lined with felt.

The Hover, already mentioned in the chapter on Poultry House construction, should have been previously heated up to 85F.—90F., and should be kept at this temperature for the first few days, the heat being gradually dropped to 75F.—80F.

It can soon be seen if the chickens are warm enough, by observing whether they huddle inside the Hover or not. Be very careful of chills, but by all means get the chickens to go out into the grass run after the first few days.

If hatching early in the season, careful watch must be kept as regards change of weather, cold winds, and undue exposure.

For the first thirty-six hours, chickens require no food, but after that time, scatter a little mixed seed ("Chicko") on a piece of paper, and also place some fine grit and charcoal before them. On the second day the chickens may have water, but it is not desirable to keep it in front of them all the time.

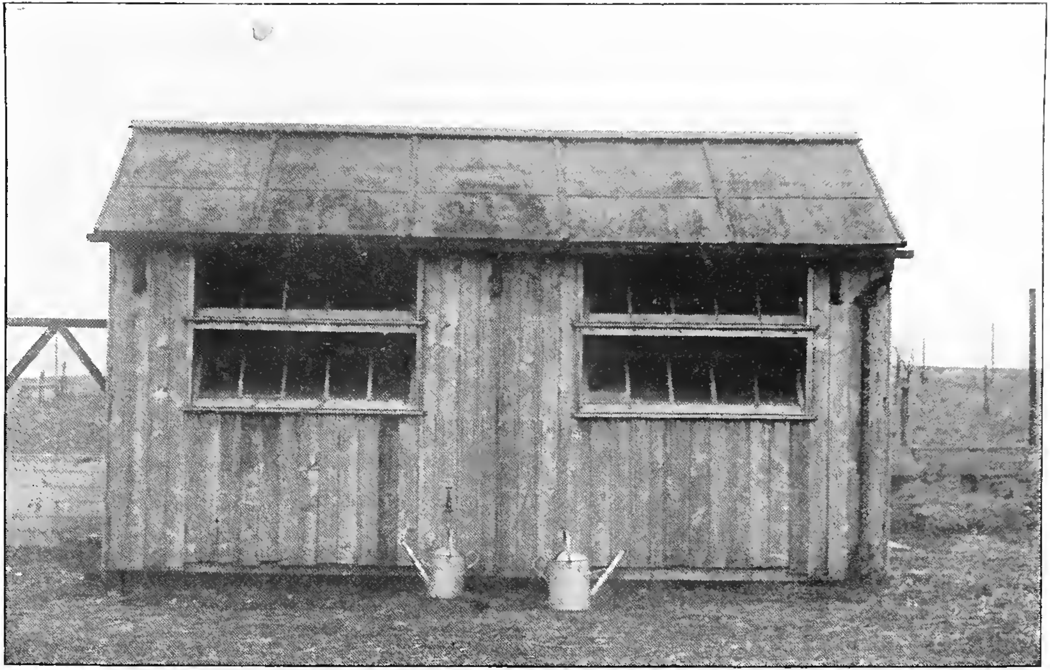
Opinions differ as to the rearing of chickens; some advise dry food all the time, and this is no doubt excellent for pre-war times.

In the case of the small man raising a few chickens with the help of a broody hen, sour milk or butter-milk may be given them to drink, and the first feed may consist of part of a hard-boiled egg, chopped fine, mixed with bread crumb, etc., but on a Commercial Poultry Farm such methods are impossible, when most likely during the hatching season thousands of birds have to be dealt with.

At the Longfield Poultry Farm the chickens receive dry food for the first few days, and then are allowed one meal of soft biscuit, in addition, and "Chicko" all the other meals. Many say chickens must be fed every two hours, but this is not really necessary. Experience is what is wanted, and by being constantly among them, one can soon see when the chickens are ready for another meal. A fault many people fall into is to overfeed the chickens, and so not to have them eager for their next meal.

When about a month to six weeks old, the chickens should be taken from the Brooder House to a small Cabin House. This at first is provided with a Hover to get them used to the change, and then gradually accustom them to do without any heat.

The Cabin House is a small house 6 feet by 4 feet, holding about 50 birds, in which the pullets remain until three quarters grown. The chickens are allowed to perch as early as they like, and are encouraged to do so. At each meal plenty of food is given and as much variety as possible, as the great thing is to keep the chickens growing.



Large Pen House for 100 Birds.

The food, however, is never left before them all the time, but as soon as it is seen that they have had enough, any surplus is at once removed.

Early chickens, though the weather in the north is usually severe during the first months of the year, are much easier to rear than late ones, and if people would only learn to understand that early pullets mean a full egg basket in the autumn, they would hatch out much earlier than a good many do now.

For the heavy birds, the last week in February to the end of March, is ideal, and for the light birds, from the last week in March to the end of April.

Rearing under these conditions will ensure the pullets, if reared properly and kept growing, laying in October, the season of the year when eggs are most in demand as the year-old birds are then at the beginning of their moult. The following points should be carefully remembered :—

(1) Before starting the Brooder House or Foster Mother, be careful to thoroughly disinfect and cleanse it.

(2) Have the Hover lamps burning for at least a day before introducing the chickens, and be careful the lamps are burning properly.

(3) Always put fresh water in the drinking vessels each time; a drop of "Izal" in the drinking water is a good thing.

(4) Disinfect the drinking vessels regularly.

(5) Remember that young chickens are very susceptible to musts and moulds, therefore never give any grain food which is in the slightest degree tainted or old.

(6) Green food is excellent for chickens. chopped mangold being as good as anything, but do not leave the old mangold lying about the runs. Remove what is left the day before, before putting down fresh slices.

(7) Give the chickens plenty of fresh air, but regulate the Brooder House windows so that only those are open on the side of the house away from cold winds.

8) Do not mix older chickens with young ones. In-Cabin Houses keep all hatches separate.

CHAPTER V.

Foods and Feeding.

THE question of the composition of foods, and the rational and scientific basis of feeding a proper diet, is now better understood than it was ten years ago. A great amount of work has been undertaken in this direction, not only in this country, but also on the Continent and in the United States.

Life from the physical standpoint comprises processes involving constant change of substance and consumption of material, which bring about the need of replacement, necessitating a certain amount of food to maintain the body in its normal state. When increase of the body or growth takes place, still more food is required, and if in addition a useful product is to be maintained, such as eggs, then more food still must be given, because the art of production involves work which brings about the wear and tear of the body tissues.

This wear and tear is again rebuilt by substances existing ready formed in the foods consumed or produced by the splitting up or partial combustion of some of the food constituents in the body. Further, food is necessary to maintain the heat generated within the body by the combustion of the materials consumed as food.

The constituents of foods are divided into two main divisions, Nitrogenous and Non-nitrogenous. The Nitrogenous constituents consist of Albuminoids and Amides, the Non-nitrogenous comprising Fat, Carbo-hydrates, Woody Fibre, and Mineral Ash. The Albuminoids or Proteids are frequently described as flesh formers, and can, in themselves, supply most of requirements of the body, a statement which cannot be made of any other food constituent. They enter into the composition of the framework of the body, they build up and repair the muscles and tendons, and supply the albuminoids of the blood and other fluids. They are burnt in the body and may serve as fuel to produce heat and energy. Proteids, therefore, are the most valuable and most expensive food constituents to purchase.

The Albuminoids in grain, roots, and other vegetable substances, are similar to those found in milk, blood, and flesh. When the nitrogenous tissues or the albuminoids consumed as food are oxidised in the body, the nitrogen they contain is not burnt, but excreted as urea. When the albuminoids, either of the wasting tissues or the food, are only partly oxidised, fat as well as urea may be produced. For example, when 100 parts of albuminoids are partially oxidised, they theoretically yield 47 parts of fat.

The Amides, although they contain nitrogen, are of comparatively small value as flesh formers. Consumed as food, they are burnt in the body producing heat, and therefore serve the same function in the body as the carbo-hydrates. Their nitrogen is excreted as urea.

Amides cannot supply the place of albuminoids as muscle-formers, but they assist in protecting the albuminoids of the food from waste. They are not present to any large extent in cereal grains.

The fats are bodies composed of carbon, hydrogen and oxygen, and those found in plant foods are similar to those found in the animal body. They may be transformed from one kind to another in the digestive system, or absorbed directly without change.

The carbo-hydrates are composed of the same chemical elements as the fats, but the oxygen and hydrogen are present in the proportion to form water, hence the name. The carbo-hydrates are the starches, pentosans, sugar and cellulose, and these form the larger proportion of vegetable foods. They are not stored up in the body as such, but serve as fuel, and are capable when consumed in excess of the immediate requirements of being converted into fat. They are, moreover, quite incapable of adding to the nitrogenous tissues, but they may, however, have indirectly the effect of protecting the albuminoids of the food from oxidation when a moderate allowance of albuminoids are supplied to a growing animal or bird. There will be produced a much larger increase of muscle when the nitrogenous constituents are accompanied by a liberal supply of carbo-hydrates. Under such conditions the non-nitrogenous ingredients of the food supply—the demands for heat and work, and the nitrogenous bodies can be devoted to body renovation and increase of tissues.

The mineral ingredients present in the food are the same as those found in the animal body, and chiefly consist of phosphate of lime and potassium. These constituents are selected, as required by the body, from the digested ash constituents.

If the above facts are borne in mind concerning the food ingredients, and the functions they perform in the economy of the body, it is easy to understand how it is that some foods are of more value than others. The digestibility of the ingredients is a point of the greatest importance, and one always to be taken into consideration when estimating the value of food, in fact, digestibility is the point around which the whole question of what is a suitable food, and what is not, revolves.

Poultry foods may be divided for the purpose of this chapter into six classes viz :—

(1) Foods rich in albuminoids (proteids) and oil.
(2) Food moderately rich in albuminoids and in oil.
(3) Foods rich in albuminoids and poor in oil.
(4) Foods poor in albuminoids and oil, but rich in carbo-hydrates (starch).
(5) Carbo-hydrate foods containing a large proportion of moisture, and lastly, foods of animal origin.

Under the first section may be classed palm-kernel cake, linseed and linseed cake, and other feeding cakes, brewers' grains, distillers' grains, and maize gluten feed.

Under the second section, rice meal and maize-germ meal.

Under the third section, peas, beans, and malt culms.

Under the fourth section, wheat, barley, oats, dari, buck-wheat, mill offals, such as sharps, middlings, bran and wheat screenings, etc.

Under the fifth section, mangolds, turnips, sugar-beet, potatoes and kale, and under the last section, meat meal, bone meal, fish meal, skim milk, and butter-milk.

LINSEED CAKE.

This is the refuse part or residue of the seed which is left after the extraction of linseed oil by power or hydraulic pressure. Linseed is grown in many parts of the world, and varies very much in composition. In the Journal of the Royal Agricultural Society for 1872, the late Dr. Voelcker, in a paper on the subject, gave the following table of cleaned linseeds from various parts of the world :—

	Moisture.	Oil.	Albuminoids.	Carbohydrates.	Crude Fibre.	Mineral Ash.
Bombay	8.01	30.21	21.81	20.85	8.36	2.76
Morschauski ...	10.01	30.81	25.60	21.50	8.30	3.77
Black Sea	10.40	30.78	26.62	17.30	11.40	3.50
Riga	10.64	31.19	22.19	22.71	9.38	3.89
St. Petersburgh	9.61	35.31	20.19	24.71	5.92	4.26
Alexandria......	5.47	35.73	19.31	26.22	8.70	4.57

From the variations in composition of linseed from these different sources, as well as the methods and machinery employed in extracting the oil from the seeds, both at home and abroad, wide variations are found in the composition of the cakes as obtained from time to time on the market. Even in the same brand of cake, it does not follow that the composition is always constant, as differences in the nature of the crushed seed may materially affect the feeding value. The following analysis will give a general idea of the average composition of English (A), American (B), Russian (C), and Bombay (D) linseed cakes :—

	A.	B.	C.	D.
Moisture	11.16	9.70	11.70	7.35
Oil	9.50	7.50	9.70	15.63
Albuminoids	29.50	37.30	35 25	31 37
Carbo-hydrates	35.54	33.50	30.35	25.55
Crude Fibre	9 10	7.00	7.70	9.60
Mineral Ash	5.20	5.00	5.30	10.50
	100.00	100.00	100.00	100.00

COTTON CAKE.

This cake occurs in two forms, the decorticated and undecorticated varieties. Cotton seed is somewhat smaller than the ordinary bean, and is enclosed in a thick blackish husk, to which short fibres of cotton-wool are very often attached. If the seed has been pulled some time and has become old and stale, it is almost impossible to remove the husk or "decorticate" it, as it is called, so that all the decorticated cotton cakes are produced where the plants are grown and from seed in the fresh state.

When it is stated that the cakes have been manufactured in England, this means that the foreign-ground cakes have been subjected to finer grinding and repressing.

Cotton seed cake and meal are very rich concentrated foods. Choice cotton cake should be bright in colour, sweet in odour, soft and pliable in texture, and should produce, when properly ground, a bright meal of deep canary colour. The following are analyses of decorticated cotton cake :—

	A.	B.	C.	D.	E.	F.
Moisture	8.30	13.56	11.88	13.45	11.23	9.28
Oil	12.41	5.75	5.21	5.18	12.35	16.05
Albuminoids	44.29	23.04	23.92	27.47	41.25	41.29
Carbo-hydrates.	26.24	32.27	32.73	28.85	21 65	16.45
Crude Fibre	3.08	19.78	20.74	19.65	5.17	8.92
Mineral Ash	5.68	5.60	5.52	5.40	8.35	8.05
	100.00	100.00	100.00	100.00	100.00	100.00

Cocoa-nut Cake.

This cake is made from the fleshy part or inner side of the cocoa-nut, from which the greater part of the oil has been extracted by hydraulic pressure. There are, however, some varieties of cocoa-nut cake, which are made by the natives, who extract the oil by means of hand pressure. In the latter cakes, as much as 30 per cent. of oil may be found.

One of the great drawbacks to the use of cocoa-nut cake lies in the fact that it very soon becomes rancid, when it is unfit for feeding purposes. Large quantities of dried cocoa-nut are from time to time imported into this country under the name of "Copra." This, when subjected to hydraulic pressure, constitutes the English-made cocoa-nut cake. The following are analyses of English (A), American (B), and native cocoa-nut cake (C).

	A.	B.	C.
Moisture	9.01	9.00	11.43
Oil	9.20	13.80	23.40
Albuminoids	21.19	21.00	20.09
Carbo-hydrates	43.04	34.30	32.71
Crude Fibre	11.91	16.00	6.77
Mineral Ash	5.65	5.90	5.60
	100.00	10.000	100.00

PALM-NUT CAKE.

This cake is produced from the palm-nuts or kernels, which are the seed of the palm tree. These nuts contain about 50 per cent. of oil, which is a solid at ordinary temperatures and goes under the name of palm butter.

Palm-nut cake is made largely on the Continent, and also to a smaller extent in this country. The following are analyses A and B of palm-nut cake as offered on the English market. Also palm-nut meal (C).

	A.	B.	C.
Moisture	9.71	9.14	9.99
Oil	9.20	13.20	12.91
Albuminoids	15.91	16,62	16.18
Carbo-hydrates	40.77	36.22	35.57
Crude Fibre	19.60	21.21	21.80
Mineral Ash	4.81	3.61	3.55
	100,00	100,00	100,00

SOYA BEAN CAKE.

This cake, which was introduced a few years ago to the English market, is the residue after pressing the oil from the Soya or Soja Bean (Glycine hispida) which is a leguminous plant extensively cultivated in Manchuria, China and Japan. The beans are rich in albuminoids, richer in fact than any ordinary beans and peas, containing from 15 to 23 per cent. of oil and 28 to 44 per cent. of albuminoids. An average sample of the beans will contain about 17 per cent. of oil and 37 per cent. of albuminoids. The following are analyses of Soya Bean Cake.

	A.	B.	C.
Moisture	11.56	12.70	12.25
Oil	5.79	11.07	9.16
Albuminoids	42.56	38.82	40.61
Carbo-hydrates	30.31	26.51	27.52
Crude Fibre	4.45	5.85	5.21
Mineral Ash	5.33	5.05	5.25
	100.00	100.00	10.000

MAIZE AND MAIZE CAKES.

Maize or Indian corn is the great American stock food. It is grown commercially in every state in the Union, with the exception of Arizona, Idaho, and Navada.

Maize is a carbonaceous food, and its chemical composition has been extensively studied by the New Jersey experimental station. The following table is taken from one of the stations' bulletins on the subject :—

PERCENTAGE COMPOSITION OF DRY CORN KERNEL.

	Percentage of parts.	Ash.	Pro-tein.	Fibre.	Nitrogen free extract.	Fat.
Original Kernel	100	1.7	12.6	2.0	79.4	4.3
Skin	5.5	1.3	6.6	16.4	74.1	1.6
Starchy & hard parts	84.3	0.7	12.2	0.6	85.0	1.5
Germ	10.2	11.1	21.7	2.9	34.7	29.6

The following are analyses of Maize, and various maize products, showing at a glance the general composition of these articles:—

	Maize.	Germ.	Meal.	Cake.	Cake.
Moisture	12.55	14.60	9.88	10.26	11.52
Oil	4.37	24.46	5.89	4.82	8.40
Albuminoids	10.62	14.73	11.55	11.73	12.35
Carbo-hydrates	69.71	32.25	64.97	65.81	59.74
Crude Fibre	1.50	7.44	4.09	3.83	1.24
Mineral Ash	1.25	6.52	3.62	3.55	6.75
	100.00	100.00	100.00	100.00	10.000

	Corn Gluten Meal.		Corn Gluten Feed.		Hominy Feed.
Moisture	9.35	...	8.30	...	10.14
Oil	1.65	...	2.60	...	6.26
Albuminoids	40.06	...	25.31	...	11.25
Carbo-hydrates	47.21	...	52.71	...	64.42
Crude Fibre	1.08	...	7.29	...	5.08
Mineral Ash	0.65	...	3.79	...	2.85
	100.00	...	100.00	...	100.00

	Water.	Albuminoids.	Oil.	Ash.	Fibre.	Soluble Carbo-hydrates.	Food Units.	Ash insoluble in HCl
Maize	12.80	10.85	4.68	1.70	1.88	68.09	107	0.1
Meal	13.11	10.67	4.40	1.42	1.98	68.42	106	0.1
,,	14.70	9.27	3.80	1.22	1.95	69.06	102	0.1
,,	12.59	9.62	4.66	1.38	1.98	69.77	105	0.1
,,	11.69	10.15	4.74	1.48	2.38	69.56	107	0.1
,,	11.34	9.45	5.24	1.56	1.45	70.96	108	0.1
,,	12.47	8.75	3.21	1.52	1.77	72.28	102	0.1
,,	13.36	10.50	4.15	1.38	1.75	68.86	105	0.1
,,	13.71	10.85	3.65	1.36	1.90	68.53	105	0.1
,,	11.45	10.32	4.91	1.38	1.87	70.07	108	0.1
Average	12.7	10.0	4.3	1.4	1.9	69.5	105	0.1

Microscopic Examination—Maize only detected.

All the above meal samples were tested for boron compounds and for salt: these preservatives were absent in every case.

Uvecco (pre-war).		Uvecco (present time).	
Moisture	11.42	Moisture	14.76
Oils...	3.10	Oils	3.58
Albuminoids ...	16.28	Albuminoids ...	19.95
Carbo-hydrates .	66.15	Carbo-hydrates .	46.87
Crude Fibre ...	1.54	Crude Fibre ...	5.32
Mineral Ash ...	1.51	Mineral Ash ...	8.76
	100.00		100.00

Before ending these remarks on cakes and meals, a word of warning is necessary as to the use of Castor Bean Meal, a product from the seeds of ricinus communis. These seeds contain a poisonous proteid ricin. The purgative action of the oil is due to the fatty acids containing Ricinoleic Acid as the principal member.

During the war, Castor Bean Meal has made its appearance on the market as a poultry food. It most certainly should not be used in any mixture for feeding purposes, in the opinion of the authors, on account of the poisonous principal contained in these beans. Ricin is known as a toxalbumin belonging to a class of substances which occur in many higher plants.

In Plant Chemistry, toxalbumins are classed under ptomaines on account of these products producing increased salivation, diarrhœa, vomiting, and finally death. A case of acute poisoning by a single castor oil seed is given in the British Medical Journal for 1905.

The following is the analysis of a sample of Castor Oil Bean Meal:—

Moisture...........	10.50	per cent.
Oil	3.48	per cent.
Albuminoids	33.05	per cent.
Carbo-hydrates ...	16.35	per cent.
Crude Fibre	30.40	per cent.
Mineral Ash	6.12	per cent.
	100.00	

Even assuming this was a good food to use in other respects, the high amount of indigestible crude fibre should condemn its use as a food for poultry purposes.

RICE.

Rice is found in commerce in three different states, viz.: unhulled, hulled, and polished. In addition, there is rice meal, the broken fragments from polishing and hulling and rice bran. Rice is a cereal in which the starchy matters predominate, and in which there is a marked deficiency in albuminoids and fat, as compared with other cereals. The following analyses of rice products may be found of interest:

	Unhulled Rice.		Hulled Rice.		Polished Rice
Moisture	10.50	...	12.00	...	12.40
Oil	1.60	...	2.00	...	0.40
Albuminoids	7.50	...	8.00	...	7.50
Carbo-hydrates ...	67.40	...	76.00	...	78.80
Crude Fibre	9.00	...	1.00	...	0.40
Mineral Ash	4.00	...	1.00	...	0.50
	100.00	...	100.00	...	100.00

	Rice Meal.	Rice Meal.	Rice Meal	Rice Meal.
Moisture	11.50	10.25	9.10	9.70
Oil	7.30	9.63	15.46	10.90
Albuminoids	9.90	10.42	13.31	10.10
Carbo-hydrates	63.30	46.20	48.00	49.90
Crude Fibre	2.70	14.90	6.23	9.40
Mineral Ash	5.30	8.60	7.90	10.00
	100.00	100.00	100.00	100.00

With regard to the above analyses, it may be stated that No. 2 is a meal of Canadian origin. Many Canadian and Italian meals are high as regards the crude fibre, whilst many of the meals (No. 3) from Rangoon and Madras are richer in oil than English, Canadian or Italian samples.

Meal from Ground Rice Shades.	
Moisture	9.60
Oil	1.91
Albuminoids	2.86
Carbo-hydrates	36.29
Crude Fibre	30.24
Mineral Ash	19.10
	100.00

Damaged Rice Flour.	
Moisture	14.60
Oil	1.04
Albuminoids	6.90
Carbo-hydrates	75.38
Crude Fibre	0.68
Mineral Ash	1.40
	100.00

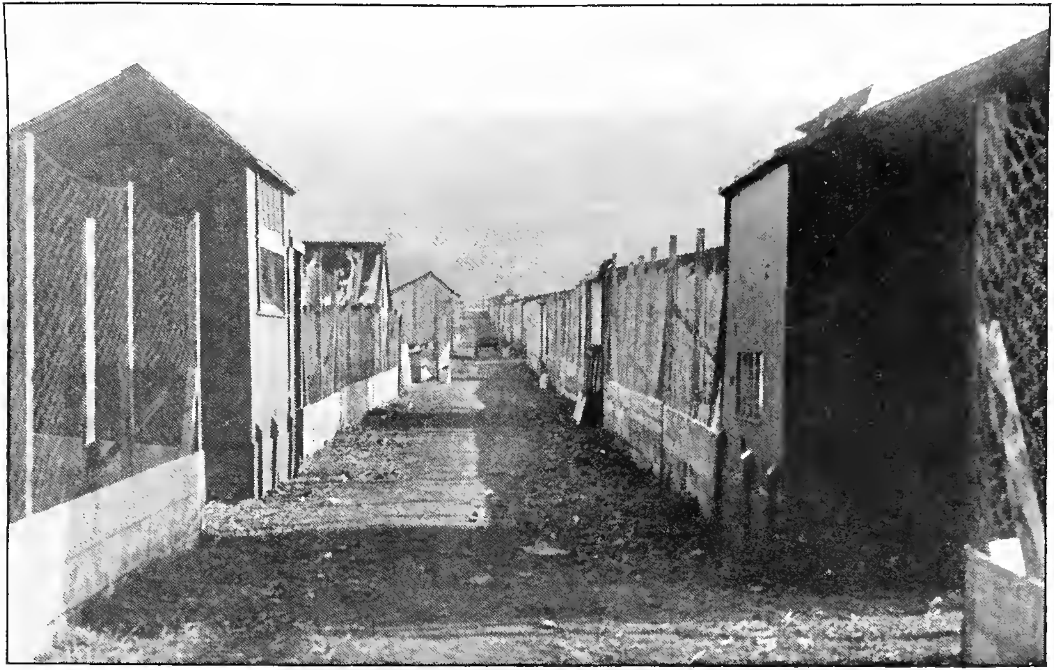
WHEAT.

Wheat is one of the most important cereals used by poultry keepers. When the grain of wheat is crushed between mill stones, and is then sifted, it is separated into two chief parts, flour and bran. The bran consists chiefly of the outside harder part of the grain, which is not so easily crushed, and when it is crushed, darkens the flour. It is therefore usually removed by the miller by means of sifting, when the whole grain is ground up, then what is known as whole meal is produced.

The bran, which is separated from the fine flour, is somewhat more nitrogenous than either the grain of wheat as a whole, or the white flour, the whole grain containing on an average twelve per cent., the bran fourteen to eighteen per cent., and the flour ten per cent. proteids.

Barley resembles wheat very much in composition and feeding value, whereas oats are characterised by containing more fat than either of the other two cereal grains. One of the special characteristics of all the cereal grains—wheat, oats, barley, rye, and maize—is their richness in an easily digested carbo-hydrate, viz. :—starch. There have not, up to the present, been a great many digestion experiments as regards poultry, but a certain number have been carried out by some of the American Agricultural Experimental Stations. The results obtained with maize, oats and wheat show marked differences in the digestibility of several of their nutrients. The crude protein, albuminoids and carbohydrates are assimilated in much greater proportion in maize than in oats, whilst the digestive co-efficient for the crude protein of wheat is intermediate in value between the average results of these two grains.

The availability of the fat in maize is slightly greater than that found in oats, whilst the digestibility of the crude fat in wheat is much less than in maize or oats. It has been found that chickens consume a much greater quantity of maize than oats—an important fact to be kept



General View of Gangway, showing Small Pen Houses.

in mind in a comparison of the digestion co-efficients of these two grains.

The nutritive superiority of maize over oats is indicated by the body-weight. With regard to wheat offals, a certain amount of confusion has arisen, from time to time, owing to variations in the milling practice in different districts, and that whilst large mills separate their offals into four grades, many small country mills are satisfied with a much less complicated separation.

Mill offals differ from one another in size of particles and in composition. The coarsest offal is taken out as bran, and the flour consists of particles which pass through silk (No. 10), having 130 meshes to the linear inch. The portion which will not pass through this mesh constitutes the offals. Offals fall approximately into three grades, viz.: —Grade 1, called "fine middlings," which will not pass through silk No. 10, but pass silk No 3; Grade 2, called "coarse middlings," which do not pass sieve No. 3, but pass wire sieve No. 24; Grade 3, called "pollards," which do not pass wire sieve No. 24, but pass sieve No. 16, having 16 meshes to the inch.

The quantities of fibre and carbo-hydrates continuously increase as the size of the particles become larger, but as regards albuminoids and fat, the greatest amount are in the coarse middlings, due to the fact of the concentration of the germ in this grade.

The products of smaller mills making offals, often run several grades together, for instance, mixtures of Grades 1 and 2 are frequently known as "straight-run middlings," or Grade 2 and 3 may be run together as "straight-run pollards." Other names employed in different districts for offals are—"seconds," "fine thirds," "biscuit middlings," "sharps," or "coarse pollards."

The following are a number of analyses of sharps (coarse pollards) made by Mr. C. C. Duncan, of Worcester, which appeared in a paper on the composition of Barley Meal, Maize Meal and Sharps, in the "Agricultural Students' Gazette" of the Royal Agricultural College for December, 1911 :—

	Water.	Albuminoids.	Oil.	Ash.	Fibre.	Soluble Carbohydrates.	Food Units.	Ash insoluble in HC l
Sharps	13.73	16.62	4.20	3.96	5.72	55.77	110	0.2
,,	12.81	16.45	3.64	4.04	5.80	57.26	107	0.3
,,	11.92	15.92	3.59	3.58	5.77	59.22	108	0.2
,,	12.97	15.57	3.62	3.60	6.16	58.08	106	0.2
,,	10.34	13.30	3.44	5.12	6.51	61.29	103	0.9
,,	13 04	15.75	3.74	3.20	6.02	58.25	107	0.3
,,	14.18	16.18	4.06	3.78	5.71	56.09	107	0.2
,,	15.02	16.62	4.01	4.64	5.71	54.00	106	0.6
,,	13.70	15.75	3.90	4.16	5.94	57.08	106	0.2
,,	10.13	16.27	4.18	3.80	5.85	59.77	111	0.1
,,	11.56	16.62	4.22	4.14	6.12	57.34	109	0.6
,,	13.24	16.97	3.82	2.92	5.20	57.85	110	0,1
,,	13.12	15.92	3.98	1.92	4.74	60.32	110	0.2
,,	13.53	15 05	4.17	5.28	8.85	53.12	101	0.5
,,	13.67	15.05	3.48	2.16	6.46	60.18	107	0.3
,,	15.12	16.62	3.70	4.30	6.11	54.15	105	0.8
,,	12.97	14 70	3.42	2.36	4.72	61.83	107	0.1
,,	13.46	15.40	4.00	4.36	6.12	56.66	105	0.6
,,	12.70	15.13	4.62	4.58	8.02	54.95	104	0.8
,,	12.28	16.97	4.32	4.26	5.70	56.47	110	0.2
Average	12.90	15.80	3.90	3.80	6.00	57.40	107	0.4

The analyses of Wheat Germ, Bran and Wheat Screenings are as follows:—

	Wheat Germ.	Wheat Germ.	Bran.	Screenings.
Moisture...............	9.92	12.03	11.42	11.30
Oil	10.54	7.68	4.36	4.72
Albuminoids	27.72	21.44	16.45	12.40
Carbo-hydrates	45.76	51.18	57.02	61.11
Crude Fibre	1.50	3.87	6.48	5.76
Mineral Ash	4.56	3.80	4.27	4.71
	100.00	100.00	100.00	100.00

BARLEY.

A large portion of the barley grown in this country is converted into pearl barley and malt barley. Barley ranges from 37-61 lbs. per bushel.

As regards composition, this cereal varies with the amount and thickness of the chaff, the finer qualities having a thinner chaff and a plump grain. These varieties are best for malting and the making of pearl barley. The best malting barley contains about 8 or 9 per cent. of albuminoids.

The composition of the products obtained in making pearl barley show in the clearest manner the way in which the constituents are arranged.

In making pearl barley, the layers are successively removed—the outer layer being known as coarse dust, the next fine dust, which contains much fat, and at this stage of the manufacture also known as "pot barley." The fine dust contains much albuminoids, the third layer is known as pearl dust, and is less rich in albuminoids and fat, the final product being pearl barley.

The following analyses will show at a glance the above stages:—

	Barley.	Coarse Dust.	Fine Dust.	Pearl Dust.
Moisture	13.80	14.20	13.10	13.30
Fat	2.10	1.70	6.00	3.40
Albuminoids	11.10	7.00	17.60	12.10
Carbo-hydrates	65.60	46.80	50.50	67.20
Crude Fibre	4.80	24.60	8.50	1.80
Mineral Ash	2.60	5.70	4.30	2.20
	100.00	100.00	100.00	100.00

	Pearl Barley.	Offal from Pearl Barley Meal.
Moisture	14.70	10.10
Oil	1.20	3.90
Albuminoids	7.00	14.37
Carbo-hydrates	75.20	58.81
Crude Fibre	0.60	7.67
Mineral Ash	1.30	5.15
	100.00	100.00

From 100 parts of barley there are produced in the course of manufacture 12½ parts of coarse dust, 15 parts of fine dust, 25 parts of pearl dust, and 47 parts of pearl barley. The offals from pearl barley manufacture should certainly be more considered by poultry keepers.

Large quantities of barley are also used by the malting and distilling trades, producing such products as malt culms, dried brewers' grains, distillery grains, distillery grains sediment, malt refuse, of which the following are analyses of malt culms and dried brewers' grains:—

	Malt Culms.	Dried Brewers' Grains.
Moisture	9.80	10.01
Oil	1.03	6.93
Albuminoids	26.28	19.50
Carbo-hydrates	45.96	42.31
Crude Fibre	11.08	17.60
Mineral Ash	5.85	3.65
	100.00	100.00

	Water.	Albuminoids.	Oil.	Ash.	Fibre.	Soluble Carbo-hydrates.	Food Units.	Ash insoluble in HCl
BARLEY	9.96	13.82	2.58	2.78	3.94	66.92	108.0	0.3
MEALS.	12.41	12.60	2.80	3.22	4.65	64.32	103.0	0.4
„	12.31	13.12	2.34	2.62	4.77	64.84	103·5	0.1
„	10.84	13.47	2.52	2.92	4.18	66.07	106.0	0.2
„	12.06	13.12	2.34	3.06	5.60	63.82	102.5	0.1
„	16.11	12.07	1.66	3.50	4.91	61.75	96.0	0.2
„	12.33	12.86	2.31	4.10	5.80	62.60	100.5	0.8
„	12.44	12.51	2.39	3.06	5.37	64.23	101.5	0.2
„	11.62	12.77	2.36	3.22	4.91	65.12	103.0	0.3
„	14.18	13.12	2.40	2.34	4.68	63.88	102.0	0.4
„	13.42	12.51	2.26	2.28	4.40	65.13	102.0	0.4
„	12.70	12.95	2.74	2.64	4.14	64.83	104.0	0.6
„	11.41	10.85	1.92	2.56	5.19	68.07	100.0	0.4
„	10.71	12.60	1.74	2.32	5.12	67.45	103.0	0.2
„	11.37	12.51	2.39	2.96	5.28	65.49	103.0	0.6
„	11.40	13.56	2.70	3.70	6.75	61.89	102.5	0.1
„	11.58	12.68	3.70	3.80	5.23	63.01	104.0	0.1
„	15.08	10.06	2.26	2-52	4.38	65.70	96.5	0.1
„	11.99	10.32	2.64	3.26	4.90	66.89	99.0	0.2
„	12.26	13.12	2.44	3.38	4.48	64.32	103.0	0.4
Average	12.30	12.50	2.40	3.00	4.90	65.20	102.1	0.3

Oats are a favourite food for horses, farm stock and poultry, and also a most wholesome food for man. Oatmeal is distinguished for its richness in albuminoids and fat, containing in this respect more fatty matter than any of the other cereal grains.

The following are analyses of oats, crushed oats, oat meal and oat shudes :—

	Oats.	Crushed Oats.	Oatmeal.	Oat Shudes.
Moisture............	14.30	13.45	8.14	9.30
Oil	6.00	6.77	7.03	0.83
Albuminoids	12.00	11.12	13.17	1.31
Carbo-hydrates ...	55.70	56.92	66.97	52.74
Crude Fibre	9.30	9.14	2.75	31.87
Mineral Ash	2.70	2.60	1.94	3.95
	100.00	100.00	100.00	100.00

RYE.

In composition this cereal grain is very similar to wheat, and in nutritive qualities. It is much cultivated in the north of Europe, as it will grow in a more northerly climate than wheat.

Rye is very liable to a fungus known as ergot, and when this is present the grain is dangerous either as rye flour for human consumption or as grain or meal for animals and poultry.

The following analyses of rye and some of its products are here given :—

	Rye.	Rye.	Rye Flour.	Rye Bran.
Moisture............	15.30	14.00	12.20	12.45
Oil	1.65	1.95	2.85	3.15
Albuminoids	11.40	11.05	12.65	14.70
Carbo-hydrates ...	67.85	67.60	63.30	58.65
Crude Fibre	2.00	3.50	4.90	6.90
Mineral Ash	1.80	1.90	4.10	4.15
	100.00	100.00	100.00	100.00

DARI.

Dari, or Dhurra, is a small cereal grain much cultivated and extensively used in India, Egypt, and the interior of Africa. On the alluvial soils of the Upper Nile the plant often attains to a height of from 15 to 20 feet.

Dari is nearly equal in nutritive value to English wheat, and yields, when milled, a nice white flour.

	Dari.		Dari.		Dari Meal.
Moisture	11.30	...	10.70	...	11.50
Oil	4.00	...	3.03	...	4.93
Albuminoids	10.15	...	7.75	...	10.25
Carbo-hydrates ...	68.15	...	74.36	...	67.75
Crude Fibre	3.55	...	2.21	...	2.02
Mineral Ash	2.85	...	1.95	...	3.55
	100.00	...	100.00	...	100.00

COMPOUND FOODS AND MEALS.

In considering the above, the question may be asked, are these meals and compound foods desirable? The answer in nearly all cases must be in the negative. They are usually bought by people as a matter of convenience.

One of the authors has, during his professional work, examined a large number, especially during the past few years, and has no hesitation in stating that many are dear at any price. Such foods are on exactly the same parallel as compound cakes and meals, such as dairy cakes and meals.

Fattening cakes and general feeding cakes, which are all made by blending various feeding stuffs together, and the mixtures flavoured and sweetened by the admixture of some spice.

The quality and composition of cakes varies very much, depending largely on the skill and judgment of the makers, and also as regards the soundness of the various materials entering into the manufacture; so it is with Compound Poultry Foods, much depends on the composition and skill shown in their manufacture. We, therefore, find on the market various mixtures such as "Growing Feed," "Poultry Mash," "Egg Mash," "Poultry Feed," "Laying Meal," and many others. The composition varies as regards the uses for which they are intended. The following are some analyses of Compound Foods found on the English market:—

Moisture	11.85	per cent.
Oil	8.02	,,
Albuminoids	17.67	,,
Carbo-hydrates	43.15	,,
Crude Fibre	11.19	,,
Mineral Ash	8.12	,,
	100.00	

The microscopic examination revealed the presence of malt culms, maize bran, oat husks, crushed wheat screenings and fish meal.

Another food, having a large sale, gave the following:

Moisture	17.02	per cent.
Oil	2.60	”
Albuminoids	14.70	”
Carbo-hydrates	52.82	”
Crude Fibre	3.64	”
Mineral Ash	9.22	”
	100.00	

The analysis of the ash of the above was as follows:—

Insoluble Matter (Silica)	0.36	
Iron Oxide	0.58	
Magnesium Sulphate	2.13	(Epsom Salts)
Sodium Sulphate	2.35	(Glouber's Salts)
Calcium Phosphate	3.26	
Sodium Chloride	0.38	
Undetermined	0.16	
	9.22	

It was claimed that this was an excellent food, having distinct medicinal properties. Another poultry food gave:

Moisture	11.48
Oil	2.79
Albuminoids	23.29
Carbo-hydrates	18.15
Crude Fibre	40.22
Mineral Ash	4.07
	100.00

This food was, in the opinion of the authors, absolute rubbish, containing excessive indigestible fibre, and caused the fowls to cease laying, when given regularly, in two cases which came under observation.

A laying meal, miscroscopically examined, consisted of barley offal, malt culms, maize, rice pollards, and fish meal; a growing meal, linseed, rice pollards, clover meal, and fish meal. All these foods were offered at high prices, leaving a very handsome profit to the producer in each case.

In the States a great many of these compound poultry foods are made. The ingredients entering into the composition of what may be styled a poultry mash, consists frequently of ground oats and barley, gluton feed, alfalfa meal, wheat, bran, wheat middlings, beef scrap, fish meal, etc. In others, such as laying meals, wheat bran and middlings, ground Indian corn, oats, buck-wheat, alfalfa meal, lime stone powder and salt.

The following are analyses of three of these American feeds :—

	Poultry Mash.	Growing Feed.	Laying Mash.
Moisture	9.14	10.83	9.35
Oil	4.90	3.62	3.80
Albuminoids	16.19	14.00	18.88
Carbo-hydrates	59.77	62.38	53.22
Crude Fibre	6.20	4.31	7.65
Mineral Ash	3.80	4.86	7.10
	100.00	100.00	100.00

Care should be taken, when using any compound meals, to ascertain that too much salt is not present. In a case cited by the authorities of the Connecticut Agricultural Experimental Station, a proprietary poultry feed for chickens was suspected of having caused the death of a number in the flock. The analysis showed over seven per cent. of mineral ash, of which one per cent. consisted of common salt.

In concluding the remarks on compound poultry foods, the following statements by the authorities of the above Experimental Station on Proprietary Foods may be of interest—which are taken from an annual report issued by the State of Connecticut.

" Many of the proprietary feeds are sold at excessive prices, when their composition is considered, and furthermore, there is little relation between cost and feeding value. We find brands containing from 9.25 to 24.69 per cent. protein (albuminoids) selling for $36 per ton, brands with with 7.50 to 25 protein at $38, brands with 4.38 to 13.81 protein at $40, and brands with 9.38 to 27.31 protein at $42. One brand containing 11.88 protein sold at $45, and another containing 9.25 per cent. at $48 per ton. There is no mystery as to the components of these feeds. The higher-grade feeds contain excellent feeding stuffs, but those of low grades, against which our criticism is chiefly directed, are usually made up of very ordinary material indeed. But even with high grade mixtures of this class, it is believed that the feeder should purchase staple feeds, and mix his own rations, for considerably less than he must pay for these ready-mixed rations."

The above remarks should be taken to heart by all those contemplating the use of compound and ready-made mixtures. In any case, have them analysed chemically and microscopically. Know what you are using. Be sure the materials are sound, and that excessive acidity is not present. Also that there is no smut, due to defective cereal grains, nor moulds, and, above all, having ascertained the food units, and taken into consideration the price you are paying, see if you could not go one better, by buying your ingredients, such as middlings, bran, oats, wheat, fish meal, clover meal, bone meal, etc., and mixing the various materials obtained yourself. The result, in the authors' opinion, will justify the trouble.

The following are analyses of other products which are of interest to poultry keepers :—

	Buck Wheat.	Canary Seed.	Biscuit Meal.
Moisture	10.70	8.40	12.24
Oil	2.55	30.00	4.21
Albuminoids ...	10.12	23.50	12.36
Carbo-hydrates .	67.30	19.80	68.97
Crude Fibre ...	7.71	11.50	0.08
Mineral Ash ...	1.62	6.80	2.14
	100.00	100.00	100.00

	Beans	Bean Meal.	Peas.	Peas.
Moisture	14.14	14.50	14.20	14.10
Oil.................	1.86	1.60	1.71	2.00
Albuminoids......	28.12	25.50	22.50	22.40

	Beans,	Bean Meal.	Peas.	Peas.
Carbo-hydrates .	46.70	45.90	52.59	53.50
Crude Fibre......	6.14	9.40	5.99	4.50
Mineral Ash ..	3.04	3.10	3.01	3.50
	100.00	100.00	100.00	100.00

	Pea Meal.	Millet.	Sunflower Seed.
Moisture	13.70	14.00	8.00
Oil	1.86	3.30	23.60
Albuminoids ...	24.87	12.70	13.00
Carbo-hydrates .	52.97	57.50	23.90
Crude Fibre ...	3.90	9.50	28.50
Mineral Ash ...	2.70	3.00	3.00
	100.03	100.00	100.00

	Sunflower Seed Cake.	Hemp Seed.	Hemp Seed Cake.
Moisture	7.10	12.20	12.55
Oil	7.43	33.60	8.30
Albuminoids ...	19.01	16.30	32.38
Carbo-hydrates .	28.93	21.30	16.02
Crude Fibre ...	30.03	12.10	22.90
Mineral Ash ...	7.50	4.50	7.85
	100.00	100.00	100.00

	Clover Meal.	Skim Milk.	Butter Milk.
Moisture	13.26	90.00	91.00
Oil	2.88	0.80	0.30
Albuminoids ...	19.08	3.70	3.00
Carbo-hydrates .	30.03	4.80	5.00
Crude Fibre ...	23.86	—	—
Mineral Ash ...	10.89	0.70	0.70
	100.00	100.00	100.00

	Mangolds.	Turnips.	Swede Turnips.
Moisture	87.89	91.85	89.40
Oil	0.17	0.20	0.20
Albuminoids ...	1.32	1.05	1.40
Carbo-hydrates .	8.63	5.26	7.10
Crude Fibre ...	1.06	0.95	1.30
Mineral Ash ...	0.93	0.70	0.60
	100.00	100.00	100.00

FISH MEAL.

Fish meal is manufactured from fish offal and from whole fish which is unsaleable owing to an excessive supply. This meal should be carefully prepared, and when this has been done, forms an excellent supplementary nitrogenous feeding material for poultry.

Prior to the war, large quantities of fish meal manufactured in England were sold to the Continent, but since this business has ceased, much larger quantities have been available for home consumption.

The best fish meal contains about 50 per cent. or more of a readily digestible protein, and on this account makes it specially suitable for use with other foods relatively poor in albuminoids, such as potatoes, mangolds, cereal offals, etc. A good high-grade fish meal should not contain more than 2—3 per cent. of oil, but many meals contain more than this amount, and may be found to vary from 2 to 13 per cent. Out of 40 meals examined, the best contained 2.33 per cent. of oil, one 4.72 per cent., four about 8 per cent., three 11—12 per cent., and one 13.40 per cent. The dryer and more friable the meal the better. Damp and greasy meals should be avoided.

With regard to the nitrogenous content, the following variations were given :—

ALBUMINOIDS.

No. 1	...	51.56	per cent.	No. 6	...	44.28	per cent.
No. 2	...	50.71	,,	No. 7	...	53.85	,,
No. 3	...	53.68	,,	No. 8	...	52.50	,,
No. 4	...	43.37	,,	No. 9	...	39.91	,,
No. 5	...	43.06	,,	No. 10	...	37.26	,,

Five fish meals were recently examined, and the albuminoids content, together with the prices charged in in each case, are here given.

No. 1	Albuminoids	—53.55	per cent.	Price	per cwt.,	29/0
No. 2	,,	—48.65	,,	,,	,,	39/0
No. 3	,,	—39.91	,,	,,	,,	37/6
No. 4	,,	—59.33	,,	,,	,,	31/6
No. 5	,,	—55.62	,,	,,	,,	33/6

With regard to the mineral constituents, the chief are phosphate of lime and salt. Care should be taken that excessive salt is not present, as an excess may cause illness, and the amount under no circumstances should exceed 3 per cent.

When feeding fish meal to poultry, laying hens should not receive more than 10 per cent., and chickens not more than 5 per cent. of the whole diet.

MEAT MEAL.

This is the residue from the manufacture of meat extract. It varies in composition according to the amount of bone ground up with the meat fibre. A nitrogenous meat meal will contain about 10—13 per cent. of nitrogen.

BONE MEAL.

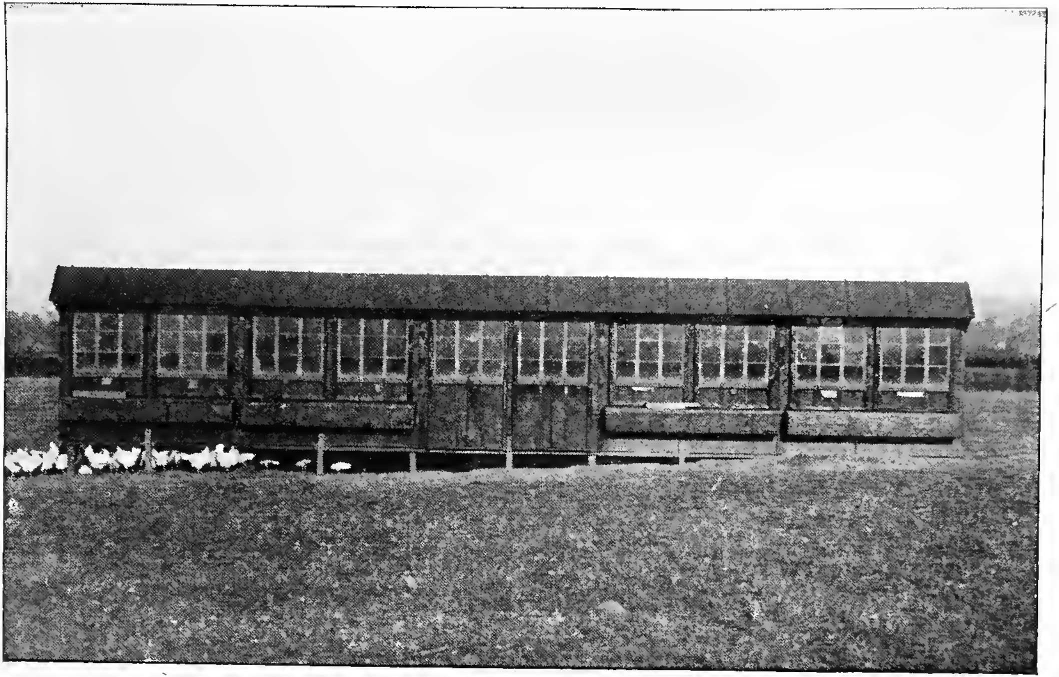
This meal is made from fresh or green bones, also in some cases from steamed or benzene extracted bones, in which latter case the fat has been removed. The nitrogenous content of raw bone is about 3.6 per cent.

The following are the nitrogen contents of 12 bone meals, recently examined :—

NITROGEN CONTENT.

No. 1	...	3.90	per cent.	
No. 2	...	3.94	,,	
No. 3	...	3.57	,,	
No. 4	...	3.78	,,	
No. 5	...	4.05	,,	—a very fine sample.
No. 6	...	3.69	,,	
No. 7	...	3.27	,,	
No. 8	...	3.50	,,	
No. 9	...	3.69	,,	
No. 10	...	3.78	,,	
No. 11	...	3.85	,,	
No. 12	...	1.60	,,	—steamed bone meal.

Having now given the composition of some of the chief foods used by the poultry keeper, some remarks are necessary with regard to the albuminoid ratio. It has already been shown that the albuminoids and non-albuminoids of food have very different functions to perform—the albuminoids supplying the nitrogenous matters of the blood, and building up the albuminous and gelantinous tissues; the non-albuminoid materials are either stored up as fat, or are burnt up to supply heat and to perform work. Thus,



PEN HOUSE 40 FEET LONG.

in considering the composition and value of a food, the relation between these two classes becomes of considerable importance. This relation is known as the albuminoid ratio.

It may be defined more particularly as the ratio of the albuminoids to the non-albuminoids calculated as starch. In order to calculate the ratio, it is first necessary to calculate the fat into its equivalent of starch, and in order to do this the amount of fat in any particular food is multiplied by 2.5. This number 2.5 has been found by experiment on the amount of heat that can be produced by the combustion of fat and starch respectively. It has further been confirmed by feeding experiments on animals. In other words, one pound of fat goes as far in heat production or fat formation as about 2½ lbs. of carbo-hydrates.

The albuminoid ratio of a food is the ratio calculated from the analysis of the food.

Example.—DECORTICATED COTTON CAKE.

Moisture	10.00	per cent.
Oil	14.00	,,
Albuminoids ...	41.20	,,
Carbo-hydrates .	18.00	,,
Crude Fibre ...	9.00	,,
Mineral Ash ...	7.80	,,
	100.00	

14 parts of Fat x 2.5 = 35.0

Fat as Starch = 35

Soluble Carbo-hydrates = 18

53

Albuminoid Ratio.

$$41.2 : 53$$

$$1 : \frac{53}{41.2} = 1 : 1.2$$

LINSEED CAKE.

Moisture	12.00	per cent.
Oil	12.00	,,
Albuminoids ...	28.10	,,
Carbo-hydrates .	30.30	,,
Crude Fibre ...	11.00	,,
Mineral Ash ...	6.60	,,
	100.00	

12 parts of Fat x 2.5 = 30.0

Fat as Starch = 30

Soluble Carbo-hydrates = 30.3

60.3

Albuminoid Ratio.

$$28.1 : 60.3 = \frac{60.3}{28.1} = 1 : 2.1$$

COMPOUND POULTRY MEAL.

Moisture	15.52	per cent.
Oil	3.58	,,
Albuminoids ...	19.95	,,
Carbo-hydrates .	46.87	,,
Crude Fibre ...	5.32	,,
Mineral Ash ...	8.76	,,
	100.00	

Fat ... 3.58 x 2.5 = 8.9

Fat as Starch = 8.9

Soluble Carbo-hydrates = 46.8

$$\underline{\quad 55.7 \quad}$$

Albuminoid Ratio.

$$19.95 : 55.7 = 1 : \frac{55.7}{19.95} = 1 : 2.7$$

The question of the albuminoid ratio is very important, and in making any mixtures, whether a dry or wet mash, should always be carefully considered, as economy in feeding is only possible when the ingredients of the food are in proper proportions. As a general rule, the best ratio to aim at, as regards feeding adult laying stock in the case of a mash, is 1 : 3.5, and including the morning feed of grain, the combined ratio should be about 1 : 4.5.

When considering foods, one often hears used the expression "intrinsic value." Intrinsic value means the combined manurial and feeding value, and from this it is possible to make a rough comparison of the respective values of two or more foods. To find the intrinsic value, add the percentage of oil to the percentage of albuminoids and multiply by 2.5. To the figure obtained, add the percentage of carbo-hydrates, and the result is the number of "food units" in the feeding stuff.

By applying this rule in the case of decorticated cotton cake and linseed cake, it will be found that the cotton cake contains more "food units" than the linseed. The former cake, therefore, is much the cheaper food, as on an average it contains 148 units as against 125 in linseed cake. The following are the "food units" of a few foods in general use :—

FOODS.	Albuminoids.	Oil.	Carbohydrates.	Food Units.
Cotton Cake (Decorticated) ... High class	39	11	23	148
Cotton Cake (Decorticated) ... Medium	37	10	22	139
Cotton Seed Meal	37	10	24	141
Cotton Cake (Undecorticated)	16	4	33	83
Linseed Cake (Russian)	26	11	33	125
Linseed Cake (American)......	30	6	34	124
Bean Meal	19	1	48	98
Pea Meal	17	1	53	98
Malt Combs	12	1	44	76
Brewers' Grains (Dried)	15	5	42	92
Wheat	8	1	69	98
Barley............................	6	2	65	85
Oats	8	4	57	87
Maize	7	4	70	97
Rice Meal.......................	6	10	47	87
Wheat Bran	8	2	56	81
Mangolds	1	?	9	12
Swedes	1	?	8	11
Turnips	1	?	7	10
Carrots	1	?	11	14
Potatoes..........................	1½	?	22	26

With regard to feeding at the present time, the following is the procedure at the Longfield Poultry Farm, as regards adult stock. The birds receive in the morning one and a half ounces of mixed grain per bird, worked into a litter, and in the afternoon a soft mash made as follows :—

Two parts ground oats or Uvecco, barley meal or biscuit meal.

Two parts bran.

One part fish or meat meal.

Two parts turnips, potatoes or cabbage (previously well boiled) and add to the mash, and then the mash dried up with three to four parts of sharps or middlings. If a change is desired, one part of clover meal is added instead of one of the vegetables, or one of the other meals mentioned above is substituted in place of the ground oats.

In order to save labour, the dry mash is most often employed, and nearly all commercial poultry farms have now adopted this system. In wet mash feeding too much time is taken up preparing the food and in feeding round. The dry mash system has its advantages in the fact that the food requires only filling up once a week, and thus considerable time, labour and trouble is saved, the birds helping themselves as they require food.

Mr. S. G. Hanson, of The Old Down, Basingstoke, in his book on "Commercial Egg Farming," gives several useful hints on dry mash feeding. He states that usually he has used ground oats and Soya-bean meal in his dry mashes, but had also obtained excellent results from 50 lbs. bran, 50 lbs. middlings, 50 lbs. maize meal, and 50 lbs. fish meal, to which has been further added one lb. salt. Mr. Abel Latham, of Briarfield, recommends three parts bran, one part malt culms, one part Indian meal, one part thirds, one part fish meal. Other good mixtures may be made up as follows :—

No. 1.	
Sharps	1 part
Bran	1 „
Maize Meal	1 „
Ground Oats	1 „
Fish Meal	1 „
Clover Meal	1 „

No. 2.	
Soya Bean Meal	1 part.
Sharps or Middlings	1 „
Bran	2 parts.
Maize Meal	1 part.
Meat Meal	1 „
Clover Meal	1 „

No. 1 Mixture for Young Chickens :—

Pinhead Oat Meal	8 stones.
Wheat Screenings	18 „
Dari	18 „
Kibbled Maize	11 „
Buck Wheat	11 „
Canary Seed	7 „
Linseed	5 „
Hemp	4 „

Mixture No. 2 :—

Wheat Screenings	18 stones.
Canary Seed	7 „
Kibbled Maize	11 „
Hemp	4 „

The Chickens did very well on this Mixture (No. 3)—

Wheat Screenings	32 stones.
Canary Seed	8 „
Small Kibbled Maize	14 „
Pinhead Oat Meal	12 „
Kibbled Rice	10 „

In concluding this chapter on foods, it cannot be too strongly impressed on all poultry keepers the importance of having all feeding mixtures carefully and correctly balanced. This can only be satisfactorily obtained by knowing the composition of the different foods that are being used, which, further, can only be ascertained by analysis. If more attention was paid to the value and importance of analysis, many serious mistakes and troubles which frequently beset the poultry keeper would vanish, and the losses incurred by using foods containing excessive acidity or in other ways harmful, would in nine cases out of ten be avoided. As Mr. Hanson so ably puts it, "Science alone can help us," whether science be applied to the actual operations or materials used on the poultry farm, or in its wider sense in improved methods of marketing, co-operation, in buying and selling, or in the general conduct of the business. It is only when practised scientifically that a Commercial Poultry Farm can pay, and will then, not only show a profitable return to the owner, but also be able to withstand the keen competition of foreign producers.

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CHAPTER VI.

Poultry Grits and other Matters.

IN addition to the proper supply of food, it is very necessary that fowls always have a good supply of grit available. As every poultry keeper knows, fowls require a supply of lime in order to form the shells of their eggs. Grit also performs the useful function of enabling the gizzard to carry out its work and grind up the food.

There are quite a number of grits on the market—some supplying lime and some not. The latter have no egg-shell-forming properties, and are only used for the silica they contain.

Grits for poultry appear on the market as oyster-shell grit, cockle-shell grit, limestone chips, silica chips made from lump quartz, grit made from the refuse of porcelain and china works, and as fine gravel from river dredgings; also combined grits, consisting of mixtures of flint and limestone mixed in certain proportions, and also combinations of flint and bone. The following are the analyses of two oyster-shell grits, as regards lime content:—

Lime... 30.90% and 41.14% respectively equal.
to ... 71.25% and 73.46% carbonate of lime.

Of limestone grits there are quite a number on the market, containing carbonate of lime from 81% to 94%, the following six samples being typical analyses made recently.

View on the Farm.

Carbonate of Lime.

No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
95.20%	84.52%	90.26%	86.4%	81.26%	82.66%

Flint grits consist wholly of silica, and supply no lime constituents whatever, their only function being to act as the teeth of the gizzard in the preparation of the food during the process of digestion.

Broken porcelain has of late been largely employed, technically known in the Potteries as "Pitchers." As long as these grits are made from unglazed material, and are free from lead compounds, they are, when ground, very suitable in taking the place of flint or quartz silica grits, but from the point of view of supplying lime constituents, they are useless, as the material having previously been through the fire in the pottery oven, the lime present and all other constituents are in the insoluble form.

The following are analyses of ordinary Tile Pitchers and China Pitchers :—

Ordinary Tile Pitchers.

Silica	78.42	per cent.
Alumina	17.45	,,
Ferric Oxide.........	0.52	,,
Lime (Cao)	3.09	,,
Magnesia	0.08	,,
Moisture	0.22	,,
Alkalies.............	0.22	,,
	100.00	

CHINA PITCHERS.

Silica	46.92	per cent.
Ferric Oxide	0.30	„
Alumina	1.84	„
Aluminium Phosphate	26.41	„
Tricalcie Phosphate	6.42	„
Lime (Cao)	18.35	„
Magnesia	0.32	„
Alkalies	0.44	„
	100.00	

The manufacture of grits is usually carried out in a crushing mill with revolving screen, the flints or other material being introduced in pieces 3 to 4 inches square, and are reduced to 5/16 inch grit and under by such a plant at the rate of 4—5 cwt. per hour. Manufacturers frequently divide the grits into three or more grades, the finest being in the form of coarse sand, and, therefore, most suitable for the use of chickens.

Poultry manure is an important item on a large Commercial Farm, and is an excellent product for intensive culture. Birds do not secrete waste nitrogen as urea, but as uric acid. The nitrogen is, therefore, not very soluble in water, but it decomposes in the soil fairly rapidly. The material will vary, due to the condition under which it is made and stored, but about 1 per cent. of nitrogen, 1 per cent. of potash, and 2 per cent. of phosphoric acid will represent a rough average.

Chicken manure, in a fresh state, contains from 50 to 60 per cent. of water, from 1 to 1.5 per cent. of nitrogen, and about 0.5 to 0.75 per cent. of phosphoric acid and potash.

When fowls are well fed, the manure contains about the same amount of nitrogen as sheep manure. Poultry manure readily ferments, and if not properly cared for, much loss of nitrogen as ammonia will result. Ordinary lime should not be mixed with it on account of the ammonia being readily liberated by alkaline compounds. The best thing to use is powdered waste gypsum.

When poultry manure is dried and carefully stored, it will contain about 4 per cent. of nitrogen, and is an excellent fertilizer for market garden use, and also on grass land.

On a large farm this question of manure, though one of the side issues of the poultry industry, should not be neglected, when it is remembered that a hen produces about a bushel of manure in a year, so that with flocks of 500 up to 2,000 to 3,000, the question of storing and disposal becomes an important item, and one which can be turned to profitable account, and made a contributing factor to the year's profit.

POULTRY SPICES AND CONDIMENTS.

The use of Poultry Spices has, during recent years, been very much on the increase, especially during the last few years, when the foods available for poultry have been undoubtedly of an inferior nature. To give any spice with food regularly is, in the opinion of the authors, harmful, unless fish meal is omitted. These spice mixtures are frequently composed of fish meal with liquorice, ginger, gentian, aniseed, malt dust, fenugreek, pepper and other seasonings.

The primitive ancestors of the present-day breeds of poultry, the jungle-cocks of Northern India (Gallus Bankiva), when they lived in the forests, doubtless would eat the fruit and leaves of many plants of an aromatic nature, which, when taken sparingly by these wild fowls, helped to improve their digestion, but there is no doubt that the continuous use of condiment mixtures added to the food of laying stock, are harmful, and though they may increase the egg production, the increased yield is obtained at the expense of the birds, which are rapidly used up under such conditions.

The proper use of spice is not as an egg-producer, as many would have us believe, but rather as a tonic to be given for a week now and then during the winter as a toner-up. The following is a very good mixture, which anyone can make for themselves at less than half the cost of advertised brands.

Spice.

Fish Meal	70	parts.
Fenugreek	20	,,
Glouber's Salts	2	,,
Oxide of Iron	5	,,
Pepper	2	,,
Curry Powder	1	,,
	100	,,

All well mixed together.

The quantity to use is one table-spoonful for about 16 birds.

The above has been used at the Longfield Poultry Farm, and by many other poultry keepers of Utility Stock, with excellent results.

CHAPTER VII.

Notes on Remedies in cases of Disease.

Apoplexy.—A soft morning mash in which nitre (Potassium Nitrate) and magnesium sulphate has been dissolved, the dose being one grain of nitre and ten grains of magnesium sulphate per bird. The treatment should be continued for a week. If there should be any difficulty in getting the birds to eat the mash, mix in a little poultry spice.

Baldness and White Comb.—Keep the runs clean, and give plenty of green food, such as mangolds, cabbage, or kale. The whiteness of the comb is often due to anœmia. An emollient of sulphur applied each night may be used as follows:—

Lactis Sulphuris	1 drachm.
Acid Carbolic	10 minims.
Adipem ad.	1 ounce. (Mix).

Give ferrous sulphate in solution with the food two or three grains per bird.

Bronchitis.—The best treatment is careful nursing, and the administration of expectorants as they are called in pharmacy, such as a mixture of glycerine or substitute used as a vehicle and mixed with ipecacuanha wine (ten drops), the mouth and nostrils being washed out with Condy's Fluid. The bird should be kept warm, and a draught of tr. camph. co. giving (five to six drops).

Bumble Foot.—If abscess present, bathe in warm water and apply boric ointment, keeping the bird on a soft floor until better.

Ulceration of the Mouth or Throat.—Swab the mouth with a lotion liq. sodii chlor. or a solution of alum or carbolic lotion, 1 in 20.

Roup.—Keep the fowls clean under hygienic conditions. Give ammoniated quinine, 15 drops in water, twice or three times a day, or potassium chlorate, 2 ounces with the same quantity of crushed sugar dissolved in a pint of water. Dose, two to three teaspoonfuls daily. Isolate the infected bird, then take each bird and squeeze out all offensive matter from the nostrils and mouth with "Izal" solution, the strength of which is 1 part Izal to 400 parts of water. Disinfect the houses and runs with unslaked lime and carbolic acid or Izal.

Cholera.—Isolate all infected birds. Give brandy or rum with water. For the first three doses add four drops of chlorodyne. When getting better, cod liver oil, one teaspoonful twice daily, and add tr. ferri perchlor, twenty drops in the drinking water. Burn all dead birds. Disinfect houses, food, and drinking troughs.

Pip or Furred Tongue.—Give soft food for a few days and two to three doses of Epsom Salts, 20 grains. The tongue should be dressed with borax lotion or honey and borax.

To prevent roup and severe colds, put one teaspoonful copper sulphate in one gallon of drinking water.

To improve the tone and vigour of birds, especially in mid-winter and spring, also useful in the moult, give one teaspoonful of cod-liver oil or put a little boiled linseed in the mash, about three tea-spoonsful for six birds.

To purify the blood and cure skin diseases, give half a teaspoonful of flowers of sulphur per bird, or sprinkle in the soft food.

To check bleeding of comb, wattles, etc., use Friar's balsam, boracic ointment or zinc ointment.

To cure insect pests, ticks, etc., use white precipitate ointment. Pyrethrum powder is also efficacious for dusting birds of all ages, suspected of parasires or insect troubles.

Powdered charcoal is excellent for birds suffering from stomach troubles caused by acidity from eating stale food.

A good mixture for moulting birds, known as "Douglas's Mixture," is made by dissolving one ounce of ferrous sulphate in one quart of water, and adding one drachm of dilute sulphuric acid. Use one teaspoonful to each half-gallon of drinking water.

Disinfect with permanganate of soda or Izal.

A very good mixture is made as follows :—

Glouber's Salts	72	parts	by weight.
Salt......................	2	„	„
Sulphur (Flowers)......	21	„	„
Oxide of Iron Powder	5	„	„

All powdered in a mortar and mixed together.

This mixture is an excellent thing to prevent colds and roup in fowls, and also gapes in young chickens, or when stock are out of condition. It can be mixed in the soft food in the following proportions : one tablespoonful to about eight hens ; for half-grown chickens, one dessertspoonful for every nine or ten birds, and in the case of young chickens, one teaspoonful for nine chicks.

Pullets which are getting near the time when they commence to lay, or in the case of laying stock which are dull and listless, give Glouber's Salts, making up a stock solution by dissolving ¼lb. in a pint of warm water, and give one dessertspoonful of this stock solution with each part of drinking water about every third or fourth day.

Sulphate of iron is an excellent toner-up, and can be given once a week in the summer, and every other day in the winter, regularly with the drinking water, at the rate of 15 grains dissolved in water for every twenty birds. It keeps the birds in condition, and is very helpful during the moult.

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CHAPTER VIII.

Tables.

AVOIRDUPOIS WEIGHT.

16 drams = 1 ounce (oz.) = 437.5 grains.
16 ounces = 1 pound (lb.) = 7,000 „
14 pounds = 1 stone
28 pounds = 1 quarter (qr.)
4 quarters = 1 hundredweight (cwt.) = 112 lbs.
20 cwt. = 1 ton = 2,240 lbs.

APOTHECARIES' WEIGHT.

20 grains (gr.) = 1 scruple.
3 scruples or 60 grains = 1 drach.
8 drachms or 480 grains = 1 ounce.
12 ounces or 5,760 grains = 1 pound.

In dispensing it is the universal custom in the British Empire, France, and the United States, to weigh solids and to measure liquids. A drop is commonly taken as the equivalent to a minim.

1 teaspoon = 1 fluid drachm.
1 dessertspoon = ¼ fluid ounce.
1 tablespoon = ½ fluid „
1 wineglassful = 2 fluid „
a teacupful = 4 fluid „
a tumblerful = 8 fluid „

Imperial Square Measure.

144 sq. inches = 1 sq. foot (sq. ft.)
9 sq. feet = 1 sq. yard (sq. yd.)
30¼ sq. yards = 1 sq. pole (sq. po.)
40 sq. poles = 1 rood (ro.)
4 roods = 1 acre (ac.)
640 acres = 1 sq. mile.
6,272,640 sq. inches = 1 acre.
43,560 sq. feet = 1 ,,
4,840 sq. yards = 1 ,,
160 sq. rods = 1 ,,
10 sq. chains = 1 ,,

Hay and Straw Weight.

36 lbs. Imperial = 1 truss.
56 lbs. of old hay = 1 ,,
60 lbs. of new hay = 1 ,,
36 trusses = 1 load.
a load of straw = 11 cwt. 64 lbs.
a load of old hay = 18 cwt.
a load of new hay = 19 cwt. 32 lbs.

Hay sold between 1st June and 31st August is reckoned new hay, and must weigh 60 lbs. per truss.

Hay sold between 31st August and the succeeding 1st June is reckoned old, and weighs 56 lbs. per truss.

Quantity of artificial manure per acre and the equivalent per square yard, manuring or liming poultry runs or small grass plots :—

Cwt. per acre	10	9	8	7	6
Ounces per sq. yard ...	3.7	3.36	2.96	2.59	2.22
Cwt. per acre	5	4	3	2	1
Ounces per sq. yard ...	1.85	1.48	1.11	0.74	0.37

Imperial Measure of Capacity.

5 ounces of water = 1 gill.
4 gills „ = 1 pint (pt.)
2 pints „ = 1 quart (qt.)
4 quarts „ = 1 gallon (gal.)
2 gallons „ = 1 peck (pk.)
4 pecks „ = 1 bushel (bus.)
8 bushels „ = 1 quarter (qr.)

Imperial Corn Measure.

2 quarts = 1 pottle (pot.)
2 pottles = 1 gallon (gal.)
2 gallons = 1 peck (pk.)
4 pecks = 1 bushel (bus.)
2 bushels = 1 strike (str.)
4 bushels = 1 coomb.
4 bushels = 1 sack.
2 coombs or 8 bushels = 1 quarter (qr.)
4 quarters = 1 chaldron.
5 quarters = 1 load.
2 loads or 10 quarters = 1 last.

A quarter of wheat, 8 Imperial bushels ... 480 lbs.

Imperial Linear Measure.

72 points = 1 inch (in.)
3 barleycorns = 1 inch (in.)
12 lines = 1 inch (in.)
12 inches = 1 foot (ft.)
3 feet = 1 yard (yd.)
6 feet = 1 fathom (fth.)
5½ yards = 1 rod, pole or perch (po.)
40 poles = 1 furlong (fur.)
8 furlongs = 1 mile (m.)
3 miles = 1 league (lea.)
69 1/9th miles = 1 degree (deg. or o).

NAMES OF COMMON CHEMICALS.

General Name.	Chemical Name.
Alum Potash ...	... Potassium-aluminium Sulphate.
Bleaching Powder	... Calcium Hypochlorite.
Blue Vitriol ...	... Cupric Sulphate.
Borax	... Sodium Biborate.
Brimstone ...	... Sulphur.
Calomel ...	... Mercurous Chloride.
Carron Oil ...	... Olive Oil and Lime Water.
Caustic Potash	... Potassium Hydroxide.
Caustic Soda ...	... Sodium Hydroxide.
Chili Saltpetre	... Sodium Nitrate.
Charcoal ...	... Carbon.
Chloride of Lime	... Calcium Hypochlorite.
Copperas ...	... Ferrous Sulphate.
Corrosive Sublimate	... Mercuric Chloride.
Cream of Tartar	... Potassium Bitartrate.
Cresylic Acid ...	... Cresol.
Epsom Salts ...	... Magnesium Sulphate.
Glouber's Salts	... Sodium Sulphate.
Graphite ...	... Carbon.
Green Vitriol ...	... Ferrous Sulphate.
Gypsum ...	... Native Calcium Sulphate.
Lamp Black ...	... Carbon.
Lime	... Calcium Oxide.
Litharge ...	... Lead Monoxide.
Liver of Sulphur	... Potassium Sulphide and Sulphate.
Lyrol	... A Powerful Antiseptic Preservative
Muriatic Acid...	... Impure Hydrochloric Acid.
Nitre	... Potassium Nitrate.

General Name.	Chemical Name.
Oil of Vitriol ...	... Impure Sulphuric Acid.
Pearl Ash ...	... Potassium Carbonate.
Paris White ...	... Calcium Carbonate.
Plaster of Paris	... Calcium Sulphate (Anhydrous).
Potash	... Potassium Hydroxide.
Plumbago ...	... Carbon.
Quick Lime ...	... Calcium Oxide.
Red Lead ...	... Lead Monoxide and Dioxide.
Rochelle Salt ...	... Sodium Potassium Tartrate.
Rock Salt ...	... Native Sodium Chloride.
Sal Salt ...	... Sodium Carbonate.
Sal Ammoniac...	... Ammonium Chloride.
Salt	... Sodium Chloride.
Salts of Lemon	... Oxalic Acid.
Salts of Wormwood	... Potassium Carbonate.
Salts of Tartar	... Potassium Carbonate.
Soda Ash ...	... Impure Sodium Carbonate.
Soda Crystals ...	... Sodium Carbonate (Hydrated).
Soft Soap ...	... Potassium Oleate or Linoleate.
Spirit of Hartshorn	... Ammonia.
Spirits of Salts	... Hydrochloric Acid.
Spirits of Wine	... Ethyl Alcohol.
Sugar of Lead...	... Lead Acetate.
Water Glass ...	... Sodium Silicate.
Washing Soda...	... Sodium Carbonate.
White Arsenic	... Arsenious Oxide.
White Lead ...	... Basic Lead Carbonate.
White Vitriol ...	... Zinc Sulphate.
Whiting ...	... Calcium Carbonate.

THERMOMETER TABLES.

Cent.	Réau.	Fah't.	Cent.	Réau.	Fah't.
0	0.0	3.20	51	40.8	123.8
1	0.8	3.38	52	41.6	125.6
2	1.6	36.5	53	42.4	127.4
3	2.4	37.4	54	43.2	129.2
4	3.2	39.2	55	44.0	131.0
5	4.0	41.0	56	44.8	132.8
6	4.8	42.8	57	45.6	134.6
7	5.6	44.6	58	46.4	136.4
8	6.4	46.4	59	47.2	138.2
9	7.2	48.2	60	48.0	140.0
10	8.0	50.0	61	48.8	141.8
11	8.8	51.8	62	49.6	143.6
12	9.6	53.6	63	50.4	145.4
13	10.4	55.4	64	51.2	147.4
14	11.2	57.2	65	52.0	149.0
15	12.0	59.0	66	52.8	150.8
16	12.8	60.8	67	53.6	152.6
17	13.6	62.6	68	54.4	154.4
18	14.4	64.4	69	55.2	156.2
19	15.2	66.2	70	56.0	158.0
20	16.0	68.0	71	56.8	159.8
21	16.8	69.8	72	57.6	161.6
22	17.6	71.6	73	58.4	163.4
23	18.4	73.4	74	59.2	165.2
24	19.2	75.2	75	60.0	167.0
25	20.0	77.0	76	60.8	168.8
26	20.8	78.8	77	61.6	170.6
27	21.6	80.6	78	62.4	172.4

Cent.	Réau.	Fah't.	Cent.	Réau.	Fah't.
28	22,4	82.4	79	63.2	174.2
29	23.2	84.2	80	64.0	176.0
30	24.0	86.0	81	64.8	177.8
31	24.8	87.8	82	65.6	179.6
32	25.6	89.6	83	66.4	181.4
33	26.4	91.4	84	67.2	183.2
34	27.2	93.2	85	68.0	185.0
35	28.0	95.0	86	68.8	186.8
36	28.8	96.8	87	69.6	188.6
37	29.6	98.6	88	70.4	190.4
38	30.4	100.4	89	71.2	192.2
39	31.2	102.2	90	72.0	194.0
40	32.0	104.0	91	72.8	195.8
41	32.8	105 8	92	73.6	197.6
42	33.6	107.6	93	74.4	199.4
43	34.4	109.4	94	75.2	201.2
44	35.2	111.2	95	76.0	203.0
45	36.0	113.0	96	76.8	204.8
46	36.8	114.8	97	77.6	206.6
47	37.6	116.6	98	78.4	208.4
48	38.4	118.4	99	79.2	210.2
49	39.2	120.2	100	80.0	212.0
50	40.0	122.0			

Cent. = Centegrade Scale.
Réau. = Réaumur Scale.
Fah't. = Fahrenheit Scale.

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